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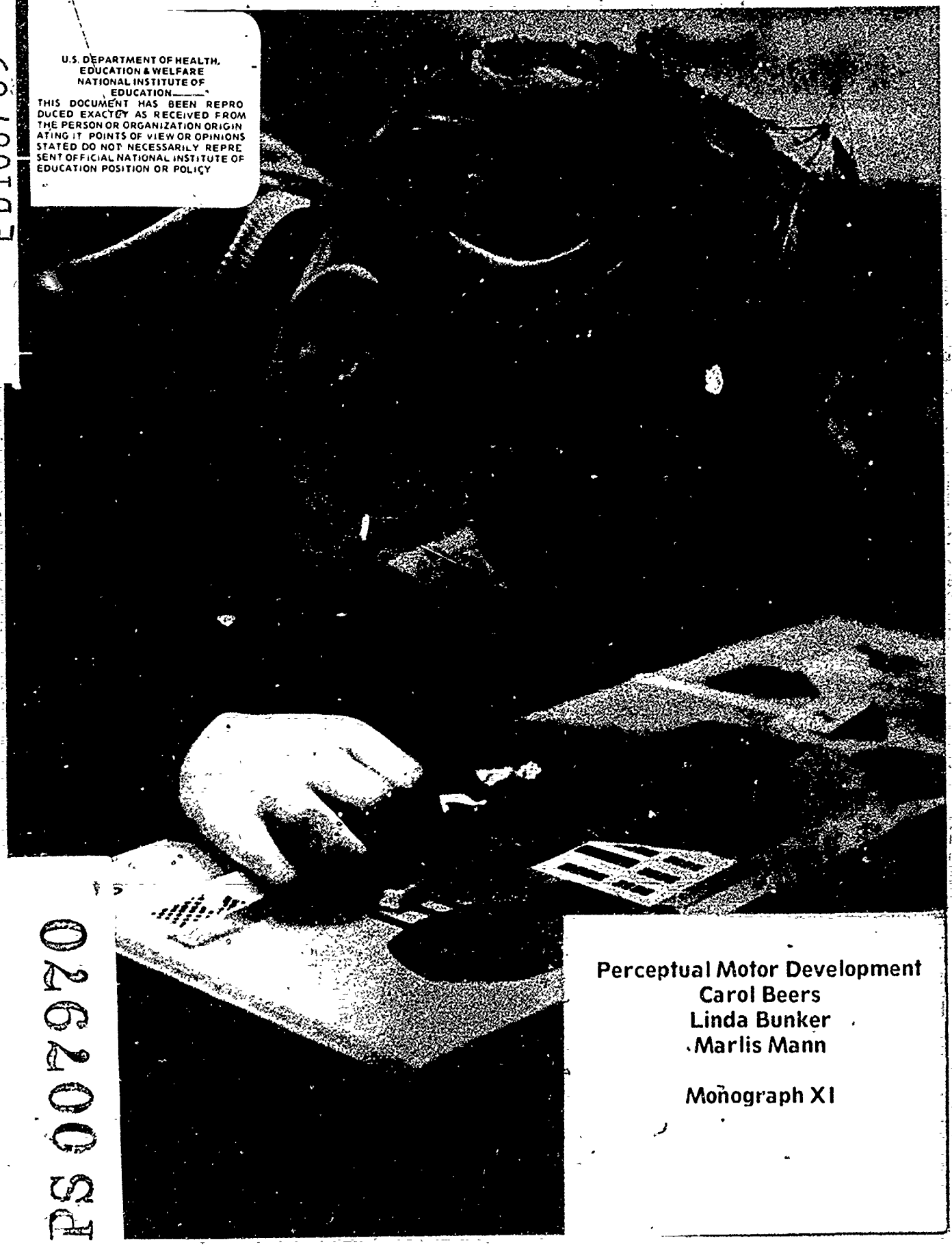
ABSTRACT

The perceptual motor development module, the eleventh in a series developed for the Early Childhood-Special Education Teacher Preparation Program at the University of Virginia, provides the student with basic information on the physiological development of young children. A number of learning and measurement activities related to children's perceptual, physical, and combined perceptual motor abilities are offered. A brief narrative is given for each area of physiological development (height and weight, and skeletal, nervous, muscular and endocrine systems), followed by available ontogenetic data. Learner characteristics charts, under each of the abilities discussed, provide information on areas of development, ontogenies and conditions necessary to work effectively with certain developmental abnormalities. Much of this dodule consists of these charts and suggested learning and measurement activities. A list of appropriate cognitive competencies needed by teachers is given. (ED)



Perceptual Motor Development

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Monograph XI

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PREFACE

The purpose of this book is to provide the reader with a description of the major areas of child development that are directly related to safe functioning in the environment. A brief narrative is provided for each area followed by available ontogenetic data. Many areas have great voids, due to the lack of research literature that is available. It is hoped, however, that some inferences can be made in terms of safe environments for children of certain ages or stages of development from the limited information that does exist.

General characteristics of physiological development are discussed because they provide the foundation upon which perceptual motor abilities are developed. Physiological development is presented in terms of the skeletal, nervous, muscular and endocrine systems.

In the area of perceptual motor development there are basically three categories of abilities that are relevant to the young child's growth. The first two categories of physical and perceptual abilities include abilities that are found necessary in several areas of perceptual motor development. The child needs different combinations of perceptual and physical abilities to develop the third category of abilities.

The first category of perceptual abilities includes those motor abilities affected by the child's perception. Specifically they are visual acuity, visual attending, visual memory, figure ground perception, perception of constancy, perceptual discrimination, depth perception, movement perception, body awareness, laterality, verticality, and directionality.

The physical abilities which comprise the second category include balance, flexibility, agility, strength, coordination and endurance.

The perceptual motor skills which comprise the last category are the fine motor skills of finger and manual dexterity; the visual-fine skills of coordination of eye-hand movements, precision of eye-hand movements and steadiness of these movements; the locomotor even and uneven skills, the nonlocomotor abilities, and finally the production and reception of propulsion.

To use this information one must first determine the abilities that comprise the given task or skill and then determine the child's functioning level in each of those areas. Levels or stages of perceptual motor development infer certain abilities, and the ontogenies suggest appropriate equipment and conditions. By looking at the learner characteristics charts under each of the activities discussed, one may refer to areas of development, ontogenies, and conditions necessary to work effectively with certain developmental abnormalities.

Information for the developmental sequences was gathered from two basic sources - existing developmental measures and research findings found in professional literature. Although many standardized perceptual motor instruments were reviewed, the instruments that were relied upon were selected because they expressed normative data for abilities in age or stage rather than raw or scaled sources. Heavy emphasis was, therefore, placed on the Bayley Scale (Bayley, 1935), Developmental Test of Visual Motor Integration (Berry, 1967), Denver Developmental Screening Test (Frankenberg & Dodds, 1967), Cattel (Cattle, 1960), Minnesota Preschool Scale (Goodenough, et al., 1940), Stanford Binet (Terman & Merill, 1960) Oseretsky Test of Motor Proficiency (Doll, 1946) and the Carolina Developmental

Profile (Lilliet Thurstone, in press). Extensive review of the perceptual abilities, physical abilities and locomotor skills literature confirmed definite gaps of developmental information in most areas with voids in others.

PHYSIOLOGICAL DEVELOPMENT

The process of perceptual-motor development can be approached by reviewing the primary developmental accomplishments of the four major body regions: head, trunk, upper extremities and lower extremities.

Most newborn babies have little control over movements of their head, but a baby of only one month can generally hold the head erect when the trunk is supported. The child progressivly overcomes the characteristic head lag, usually by 3 months. By 5 months, the baby will attempt to raise the head when being pulled from a supine to a sitting position (Bayley, 1935). The coordination of the eyes also begins as a very poor "skill" but improves so rapidly that by the end of the 4th month a normal child is capable of executing difficult types of tracking and focusing skills (Wall, 1972).

The ability to use the trunk is not present at birth. By the second month, however, the baby should be able to turn from side to side and by the fourth month from back to side. The baby will also learn to pull to a sitting position, to sit with hand support by 6 months, and between the 7th and 9th months to sit alone without support (Frankenburg and Dodds, 1967).

The motor development of the upper and lower extremities is critical to the continued development of the child. By the 4th month the child should be able to demonstrate forearm support. During the ensuing months, grasping is slow and awkward, but by the end of the 6th month, it is developed so as to allow for manipulation and transfer of objects. During the next several months the child moves from gross motor development to fine motor development. By 10 months of age, the child begins to use the fingers independently and develops prehensile skills using the thumb and index finger. By 15 months the child begins to attempt to build towers of cubes and will begin to scribble with a crayon (Wall, 1972).

The motor development of the lower extremities includes pre-walking movements from birth. The newborn makes alternate kicking movements and may assume the "fetal" position of pelvis high and knees drawn in under the abdomen. During the next 2 - 8 weeks the child begins extending his legs and gradually assuming an extended-leg position. By 4 months the child should be able to bear some weight on the legs when held, and by 7 months the entire weight may be borne. The 9-month old baby can creep and, as she/he begins to stand, progresses to the crawling stage. By 42 weeks the child should be able to stand with support and by one year should be able to pull to a stand and take a step with one hand held. From 18 months to 2 years the child walks well, begins to run, with the stairs no longer presenting an obstacle. Between 3 and 4 years of age children can negotiate stairs, ride tricycles and perform a variety of locomotor skills (Wall, 1972).

Motor development is one of the most important areas of child development because it provides for the child's ability to function within his environment. This perceptual-motor development forms the basis for subsequent development, particularly in the cognitive domain, but simultaneously provides the greatest area of concern for child safety. Motor development actually begins prior to birth, at approximately the third month of prenatal life, when the fetal muscles develop sufficiently to allow the fetus to move its limbs spontaneously. Toward the end of the fourth prenatal month, the mother can feel the fetal movements and can detect intensity and frequency variations. Fetal activities are especially pronounced between the sixth and ninth month, although activity usually decreases during the last month, probably because of the crowded condition within the amniotic sac (Wall, 1972).

Normative descriptions of the trends in the maturation process of child growth and development have been compiled by several early researchers (Hilgard, 1932; Bayley, 1935; Dennis and Dennis, 1940; Gesell, 1940; McGraw, 1945). The concept of maturation refers to inter- and intra-cellular changes which tend to be independent of environmental influence when minimum essential conditions for growth are present. Maturation is a product resulting primarily from innate processes of growth (phylogenetic) rather than by direct experiences with the environment (ontogenetic). The normative or developmental approach is based on the concept that development is inherent or genetically predetermined. This concept also suggests that physiological maturation sets the limits of what a child can learn from environmental influence. Learning occurs when conditions in the child's environment produce a behavior change that would probably not have occurred due to maturation alone. It is generally agreed that there are a few fundamental motor skills that occur because of maturation and are not modifiable through special training, i.e. creeping, walking, stair climbing (Gesell and Thompson, 1929; Hilgard, 1932; Dennis and Dennis, 1940; McGraw, 1945). More complex aspects of development appear to be modifiable through appropriate learning experiences (Dennis, 1960; Painter, 1968).

The infant's early perceptual-motor movements are random and uncoordinated. Through the process of neuro-muscular maturation and experience these purposeless movements become modified into a series of highly integrated perceptual-motor skills. The development of fine and gross motor control depends not only on the maturation of the neuromuscular system, but also on the development of the skeletal, respiratory and circulatory systems and upon the opportunity to learn to control the body. The development of muscle control parallels the development of the motor area of the brain. The cerebellum, which controls balance, and the cerebrum, which controls the more complex skills, develop rapdily during the early years of life and essentially reach mature size by the time the child is 5 years old (Wall, 1972).

General Trends in Growth and Development

There are several broad trends in motor development which appear to be relatively independent of environmental influence. These developments follow a predictable sequence which has been identified by the cephalo-caudal and proximo-distal directionalities.

cephalo-caudal principle - Growth and motor development generally proceed from the head end to the tail end of the organism. Developments of the head and trunk regions of the body precedes development of the lower extremities. For example, children can lift their heads before they can lift their bodies, and at a later stage can throw balls before they can kick them.

proximo-distal principle - Growth and motor development proceed from the axis of the body (midline) outward to the periphery. A child can move large muscle groups near the medial position of the body, such as in "shoulder reaching", before movement of body parts near the extremities like the arm and hand.

Gross motor to fine motor development - Before the child can gain control over the small muscles, the child must learn to produce coordinated movement with one arm without simultaneously moving the other. It is only after the child is capable of producing movement on one side or region of the body without producing a similar or adjustive motor

response on the other side that it can successfully perform fine or small motor activities, like those required for printing and drawing.

The fact the motor development follows a general pattern should not be interpreted as specifying a series of inflexible "rules". Child growth and development is characterized by the presence of a great many individual differences in terms of rate, detail and pattern, but especially in terms of the ages at which individuals attain different stages.

The most prominent is the general type of growth pattern which is characteristic of most of the external dimensions of the trunk and extremities and also applies to the organs of digestion, circulation, repiration and excretion. In general, there are four distinct periods of general growth: (1) a period of rapid growth in infancy with gradually decreasing velocity, extending to the fourth year; (2) a subsequent period of relatively constant growth lasting until the onset of puberty; (3) a rapid spurt at puberty; (4) followed by a gradual diminution of growth until it ceases (holte, McIntosh and Barnett, 1962).

A distinct type of neural growth occurs primarily with the rapid postnatal growth, which then slows down and ceases after puberty. This neural growth deals with the development of the central nervous system and its integuments, the eye, and much of the auditory apparatus. The genital type of growth is characterized by the slow development of the sex organs until the acceleration at puberty. A fourth type of growth is unusual in that it is characterized by rapid development until puberty but is followed in later years by partial atrophy. This lymphatic growth is characterized by the development of the thymus, lymph nodes, follicles of the spleen and lymphoid tissues of the intestines (Holt, McIntosh and Barnett, 1962).

Changes in body proportions are another predominant characteristic of development. The growth of the extremities compared to the trunk and the relative increase in the size of the body compared with the size of the head are the two most marked changes. It should be particularly noted that the neonate proportions are characterized by a large head, small trunk, and legs that are shorter than the arms. During the first year the trunk length and leg length increase at the same rate (Bayley and Davis, 1935), while during the second year the legs grow more rapidly and may constitute up to 34 percent of the total height (Meredith, 1967). As the legs, trunk and jaw grow more than the cranium, the preschooler loses the top-heavy appearance of the infant.

The overall picture of child growth can be influenced by many different factors. The sex of the child will help determine the rate and magnitude of growth. Boys are usually somewhat larger in infancy while girls tend to mature at a much more rapid rate during preschool and elementary ages (an average of 2 years earlier until post-puberty). Hereditary factors such as body build and race also play important roles, as do the environmental factors of diet, health, living standards, and emotional tone of the home. The season of the year also seems to affect growth and weight gains, with late summer and fall producing the greatest acceleration for North American children, probably because of the greater prevalence of respiratory infections in the winter and seasonal variations in diet, sleep and exercise (Holte, McIntosh and Barnett, 1962).

Height and Weight

In terms of height and weight, there is a general trend across individuals. The average neonatal size is approximately 7 lbs. and 20 inches (Meredith, 1967).

At 2 years of age the child has usually added about 75 percent of higher birth length, and at 5 years slightly over 100 percent. By 4 - 5 months the child doubles the birth weight; by 1 year the child has tripled the birth weight; at 2 years it is 4 times greater; and by 5 years is slightly over 6 times greater.

The organization of body growth has also been described in terms of maturity gradients. The growth of the extremities is influenced by earlier development of the distal portion of the limb prior to the proximal portion, i.e. at all ages the hand is nearer its adult status than the forearm, and the forearm is nearer than the upper arm.

The various components of a child's weight also vary with age. For example, the amount of subcutaneous fat increases rapidly until approximately 9 months of age, decreases rapidly to 2-1/2 years and by 5 years is only one half as thick as it was at 9 months. The variability in the ratio between muscle and fat also plays a significant role. However, there is little difference by sex until approximately 8 years of age (Rarick, 1973). The amount of systemic water is also felt to be a significant component of body composition which decreases with age (Tanner, 1962).

The transition from neonatal to early childhood is also marked by developmental changes in various physiological systems. For example, physiological functioning in the neonate is relatively unstable, with irregular breathing which is rapid and shallow and a high metabolic rate with accompnaying lack of homeostasis in temperature equilibration (heat loss is great). During the post-neonatal stage (1 month - 2 years), the basic processes become more stable, with slower respiration and heart rates, improved temperature regulation and more efficient homeostatic mechanisms. In addition, the basic biological routines of eating, sleeping and eliminating become regularized.

Several other physiological systems (skeletal, nervous, muscular and endocrine) demonstrate significant developmental trends which will be briefly summarized.

Skeletal System Development

Skeletal maturity is a measure of how far the bones of an area have progressed toward maturity, not in size, but in shape and in their relative positions. Each bone begins as a primary center of ossification, passes through various stages of enlargement and shaping of the ossified area, acquires in some cases one or more epiphyses (or centers where ossification begins) and finally reaches adult form when these epiphyses fuse with the main body of the bone. Each of these changes can be easily seen in a radiograph, which distinguishes the ossified area whose calcium content renders it opaque to the x-rays from the areas of cartilage where ossification has not yet begun (Tanner, 1962).

Several general characteristics of the skeletal system should be noted:

The ossification process extends from early prenatal stages to maturity.
Cartilage and membranous tissue becomes ossified, and mineralization proceeds from primary ossification centers in prenatal stages and from secondary centers in psot-natal stage (0-2 years).
Joints are flexible as ligaments and muscles are more tenuously attached to bones in 2-5 year olds than in older children.
The bony skeleton of the young child is easily damaged by pressure, pulling and infection.

Illness and malnutrition may leave scars on bones.
Girls tend to mature more rapidly than boys (generally about 2 years ahead in terms of skeletal maturation).
A tremendous amount of individual variability exists among members of the same sex.

The development of the segments of the skeleton progresses at different rates and in different directions, as illustrated by the following:

Head

circumference, 12-14 inches at birth, increases 33 percent in first year and 48 percent by 5 years as it approximates the adult size;
the six fontanelles that appear at birth become calcified during the first year;
deciduous teeth erupt 6-30 months; permanent teeth forming in the jaws. Calcification of permanent teeth will continue and will reflect disturbances in growth during preschool years;
the ratio of face to cranium is 1:3 at 6 years, compared with 1:8 at birth and 1:2 at 18 years.

Chest

circumference of chest at birth is slightly less than the head, but by one year, slightly greater than the head and is barrel shaped;
chest continues to broaden, flatten and the ribs change to oblique positions; by 5-6 years, some chests approach a more adult shape as the sternum and ribs continue ossification.

Vertebral Column

in the infant the spinal column is highly flexibile; the normal curves develop as the infant achieves sitting and standing postures;
by pre-school years, the vertebral column is still quite flexible and is easily misshapen, but the process of fixation is beginning and proceeds slowly.

Pelvis

narrow and horizontal on position at birth until about age 2, and will broaden, become less vertical and increase in size;
the spurt in height near age 3 is due in part to the shift in position of the pelvis and to the growth of the legs.

Extremities

the arms and legs are short, legs are bowed, and hands and feet are stubby and flexible;
leg length increases at about the same rate as trunk length during first year (Bayley and Davis, 1935);
legs and arms grow more rapidly in 2nd year, with legs constituting up to 34 percent of the total height (Meredith, 1967).

Nervous System Development

The development of the brain and nervous system is perhaps the most dramatic

and yet little understood aspect of growth. From early fetal life the brain is nearer to its adult weight than any other organ of the body, except perhaps the eye. At birth it averages 25 percent of its adult weight, at 6 months nearly 50 percent, at 2 years about 75 percent, at 5 years 90 percent and at 10 years 95 percent (Tanner, 1962). This contrasts to whole body weight, which at birth is about 5 percent and at 10 years about 50 percent.

Two clear gradients of development of the cerebral cortex occur during the first 2 years after birth. The first concerns the order in which general functional areas of the brain develop, and the second deals with the order in which body localizations advance within the areas. The most advanced areas of the cortex include (in order): the primary motor area, the primary sensory area, and the primary auditory area. The association areas lag behind the corresponding primary ones. It appears as if the developmental sequence then spreads from the primary area, with the centers located most distan[illegible] primary areas developing last.

Within the motor area the control of movements of the arms and upper trunk develop much ahead of those controlling the legs. The leg areas remain the least developed up to 2 years and presumably somewhat beyond. The gradients of development in the association areas do not appear to follow the same course, because little or no localization by body areas occur there.

The rate of development of the nervous system is characterized by the following:

- Rate is rapid in early life; nervous system attains 60 percent of adult weight from origin at 2-1/2 weeks prenatal to 1 year, post-natal.
- Quantitative growth is decelerating; brain is 60 percent of its adult weight by 1 year, 75 percent by 3 years, 90 percent by 6 years; cerebellum, which gains rapidly in late infancy, is almost adult size by 5 years.
- Asynchronous growth of parts; cerebral areas slower in development than subcortical ones.
- Subcortical centers control early infant behavior; voluntary control gradually increases from approximately 6 months on. Initially there are many well-defined reflexes but little active cortical control. However with age, cortical functioning becomes more differentiated.
- Increasing control over voluntary movements continues in preschool years;
- At 5 years smaller, faster brain waves (theta) predominate as contrasted with large, slow waves (delta) of infancy.

Muscular System Development

The growth and development of the muscular system closely parallels the development of the nervous system, primarily because of its dependence on neural activation for motion. The increase in muscle size is a natural result of the growth process, and is accompanied by an increase in strength. Boys and girls tend to develop in a similar fashion for a given body size and shape (Tanner, 1970) until puberty begins. After adolescence, however, boys are much stronger, chiefly by virtue of having larger muscles and by being able to develop more force per gram of muscle tissue. Males also develop larger hearts and lungs relative to their size, a higher systolic blood pressure, a lower resting heart rate and a greater capacity for carrying oxygen in the blood (Tanner, 1962). The developmental

sequence also reflects the general principles of cephalo-caudal, proximo-distal and gross motor-to-fine motor maturation discussed previously. Muscle growth follows a pattern similar to that of the body as a whole. With increasing age of the child, muscles change in their structure, become more firmly attached to bones, and come more under control of the cnetral nervous system.

The general growth of musculature is characterized by the following:

At birth, muscles represent 20-25 percent of body weight; fibers increase in length, breadth and thickness but not in number.

Mustles make up 20-25 percent of body weight at birth, 33 percent at adolescence. Muscle strength increases more rapidly than muscle size (Rarick, 1973).

Cephalo-caudal principle - in young infant the greatest development is in the muscles of the eye and respiratory tract, and in the arms more than the legs. Also in children, arm muscles are more developed and stronger than leg muscles, e.g., in ascending stairs, children raise their bodies more by pulling with their hand on the banister than by lifting with their leg muscles.

Proximo-distal principle - children can move the large muscles nearest the body before those near the extremities. The movements of the total arm or leg will develop prior to the coordinated movements of the hand or foot.

Gross to fine motor development - large muscles are controlled to a better degree than fine muscles, hence the child is more skillful in gross motor skills. This is true even to age 5 when control over large muscles is still more advanced than control over small ones.

The basic immaturity of the muscular system is reflected in the young child's inefficiency of movement, erratic changes of tempo and inability to sit still for long. They tend to tire easily but recover rapidly and therefore need frequent, short rests and changes of activity.

Endocrine System Development

The endocrine glands, of great importance in the control of growth and development, are one of the chief agents for translating the instructions of the genes into the reality of the adult form. The hormones particularly concerned in growth are thyroxine from the thyroid gland, cortisol from the cortex of the adrenal gland, insulin from the pancreas, growth hormone from the pituitary, and testosterone and estrogen from the gonads (Tanner, 1970).

The action of the endocrine system is a highly complex and interrelated phenomenon. Most endocrine glands secrete their hormones in response to the stimulus of a trophic hormone from the pituitary gland, which is responding as a component of a complex feedback mechanism designed to maintain homeostasis.

Many of the individual differences in tempo of growth are probably due to small differences in rates of secretion of hormones, perhaps caused by the set of feedback mechanisms on the brain. The interrelationship of the hormones is a complex phenomenon not yet entirely understood.

The general patterns of child growth and development and the interactions of the skeletal, nervous, muscular and endocrine system provide the basis upon which each child's perceptual-motor abilities develop. Many characteristics of child

development have been presented. However, perhaps most critical is the fact that each child is a unique being, with a unique genetic endowment which must be cultivated through safe and stimulating interactions with other persons and environments.

PERCEPTUAL ABILITIES

Perception is how individuals get information from their surroundings. Visual perception is a process of attaching meaning or order to incoming visual changes with age. The child develops the ability to recognize and integrate visual stimuli in the brain and to reconstitute this into the experience of surrounding objects (Gibson, 1969). This involves abstraction of differential properties of stimuli, filtering out of irrelevant variables of stimulation, and selective attention of the kind described as exploratory activity of the sense organs. Children perceive the environment in a certain way and generally in accord with a perceptual pattern. Perception is active; it focuses on selected stimuli and rejects the rest. Three kinds of developmental perceptual learning that occur are as follows:

Preference changes for various colors, shapes, textures and illuminations.
Detection of distinctive features - or the detection of differences in objects, pictures, colors, textures, and positions.
Development of constant error - the shift in slight underestimation to a greater overestimation of size at a distance.

The child's visual perception is well developed at birth, and proceeds rapidly in its further development. The human infant can sustain visual fixation on a stationary target within a few hours after birth (Ling, 1942), and within a few weeks can pursue a simple moving target with his eyes (McGinnis, 1930).

By the age of five years a number of separate visual perceptual activities emerge, which remain relatively stable through adulthood (Smith and Smith, 1966). The following visual perceptual abilities combine to enable the child to visually perceive his world:

Visual acuity - the ability to see, e.g., 20/20 vision.
Visual attending - the ability to direct and sustain attention to visual stimuli.
Visual memory - the ability to retain visual image for a period of time.
Perceptual discrimination - ability to recognize likenesses and differences between objects, forms or pictures.
Perceptual constancy - includes those permanent attributes of color, location, elements of form such as object shapes and size. Various environmental conditions such as elimination, viewing angle, distance, and position affect perceptual constancy.
Figure-ground discrimination - the ability to recognize patterns as figures against a background. Part-whole perception and visual closure are functions of figure-ground discrimination.
Depth-perception - function of binocular vision and textural differences (and not as in distance vision which is the result of differing spatial relationships).
Movement perception - perception of movement of person himself or something external to the person.
Laterality - awareness of right and left in one's own body.
Verticality - postural adjustments such as sitting, standing, reclining, bending and walking.
Directionality - the projection of concepts of laterality into space.
Body awareness - awareness of body as a whole or mass in relationship to specific objects in the environment.

Learner Characteristics: Perceptual Abilities

Terminology	Characteristics (Garrison and Force, 1965)	Areas of Development Affected by LC	Conditions for Atypical Characteristics
Alternating strabimus	This is similar to children who have to turn the trunk away from the table in order to bring one hand to the front. He may not be able to see an object by the time the hand is brought forward and may appear to grope undecidedly or may even pick up the wrong object. His eyes may have turned inward or outward by the time he reaches for what he has just seen so he has to depend on his touch and his remembered estimate of the position of the material or make an attempt to focus one of his eyes anew, in order to respond by a correct grasping and pointing. A constant or even an intermittent strabimus of one eye may cause a child to use only the other eye habitually in order to avoid blurred vision or double vision or other discomfort. A resourceful child may be able to adapt himself to this one-eyed sighting by remembering to look around, and by using appropriate scanning motions (Dunn, 19).	Visual acuity directionality	
Amblyopia	A dimness of vision due to disuse of the weak eye from improper muscle balance.	visual acuity	
astigmatism (ah-stig mah-tism)	Refractive error resulting from an irregularity of the cornea or lens of the eye. A defective formation of those curved surfaces of the eye which reflect light rays and as a result, light rays are not focused sharply on the retina, but are more or less diffused, thus giving a hazy image.	visual acuity visual attending	
blepharitis (blef-ah-ri'tis)	Inflammation of the eyelids.	visual acuity visual attending	

Learner Characteristics: Perceptual Abilities

Terminology	Characteristics (Garrison and Force, 1965)	Areas of Development Affected by LC	Conditions for Atypical Characteristics
Blind	Legal blindness is an acuity of 20/200 or less in the better eye after maximum correction or who have a visual field which is less than an angle of 20 degrees or less in the widest diameter.	By visual acuity	Cannot be educated through visual methods.
	Quantity of sensory input is restricted due to inaccessibility parts of the environment or lack of opportunity to explore that which is.	Visual Discrimination Classifies by fewer attributes without sight.	Must teach the child mobility skills so he seeks out information that would come through visual perception to the child with normal visual acuity.
	Has difficulty separating body boundaries from the environment.	Body awareness	Need to develop awareness of body parts, their interrelatedness and their connected separation from environment by active autotactual exploration of the body and the experience of being handled with the attendant extrinsic kinesthetic and tactual sensitions. Need to preview difference of "me and not me" (Witkia, Dye, Faterson, Goodenough and Kark, 1962).
cataract (kat'ah-rakt)	Is an opacity (cloudiness) in the lens of the eye. There are two types of cataracts - (a) senile cataract which is most common and appears frequently in older people; (b) congenital cataract which is found in almost every group of partially-sighted children.	visual acuity	

Learner Characteristics: Perceptual Abilities

Terminology	Characteristics (Garrison and Force, 1965)	Areas of Development Affected by LC	Conditions for Atypical Characteristics
Cerebral Palsy (five basic cate-	Types of neuromuscular disabilities which are characterized by disturbances of motor functioning resulting from damage to the brain and central nervous system. Characterized by muscle weakness or flaccidity.		A child with CP must learn to relax those muscles that become tense and prevent motion.
	excessive involuntary motion postural imbalance spascity		Child must learn to synchronize muscle groups for smoothness of movement.
1. Spacity	Involuntary contraction of affected muscles when they are suddenly stretched-called stretch reflex-resulting in tenseness and difficult, inaccurate voluntary motion (Morgenstern, 1964)	Visual attending Directionality Body awareness	Child must learn to bring uncontrolled movement under voluntary control. Braces.
2. Athetosis	Involuntary contraction of successive muscles resulting in marked incoordination and almost constant motion of the extremities. (Morgenstern, 1964)	Directionality Body awareness	
3. Ataxia	Uncoordinated movement, impaired balance, and sense of orientation in space (Morgenstern, 1964) Child can experience discomfort or dizziness when called upon to look at material closely for any length of time.	Visual attending Laterality	Child needs to learn he must look into the distance at occasionally to alleviate dizziness.
4. Rigidity	Widespread continuous muscle tension or "lead-pipe" stiffness (Morgenstern, 1964)		
5. Tremor	Rythmic, involuntary, uncontrollable motions limited to certain muscle groups (Morgenstern, 1964)	Visual attending Body awareness	

Learner Characteristics: Perceptual Abilities

Terminology	Characteristics	Areas of Development Affected by LC	Conditions for Atypical Characteristics
conjunctiva (kon-junk-ti'vah)	The delicate membrane that lines the eyelids and covers the eyeball in front and eyelids in back.		
conjunctivitis (kon-junk-te-vi'tis)	Inflammation of the conjunctiva* More commonly called "pink eye"	Visual acuity Visual attending	
diplopia (dip-lo'pe-ah)	The seeing of single objects as double or two; double vision.	Visual acuity	
hemiplegia	cerebral palsy involvement on one side of the body (Dunn, 196)	laterality body awareness	
hyperopia (hi-per-o-pe-ah)	Farsightedness; the lack of refracting power sufficient to focus the light rays reflected from objects close to the eyes. In hyperopia, the eye is too short from front to back.	visual acuity	
myopia (mi-o'pe-ah)	Nearsightedness, or short sightedness; defective eyesight due to too great a refractive power (power to deflect light) of the eye, so that the light rays coming from an object beyond a certain distance are focused in front of the retina. Eyeball is too long.	visual acuity	
monoplegia	cerebral palsy involvement in only one limb (Dunn, 19)	laterality body awareness	
nystagmus (nis-tag'mus)	An involuntary rapid movement of the eyeball, which may be either lateral, vertical, rotary or mixed. This may occur as a secondary characteristic of a variety of visual disorders or brain injury.	visual acuity visual attending	

Learner Characteristics: Perceptual Abilities

Terminology	Characteristics	Areas of Development Affected by LC	Conditions for Atypical Characteristics
optic atrophy	Degeneration of the optic nerve which connects the retina to the brain is manifested by a shrinking or wasting.	visual acuity	
paraplegia	cerebral involvement of lower part of body (Dunn, 196)	body awareness verticality	
partial vision	The ability to see less than a normal person as determined by the results of standard test of one's vision; 20/70 to 20/200 range of partial vision. Those with peripheral constancy visual angle vision (tunnel vision) of less than 20^{o} are also considered partially sighted (Bateman, 1967; Jones, 1962).	visual acuity	Can read - don't need Braille but need alteration in educational procedure such as enlarged print
ptosis (to'sis)	Drooping of the upper eyelid.	visual acuity	
quadriplegia	Paralysis of incoordination of all four extremities (Dunn, 196).	laterality verticality directionality	
strabismus (strah-biz'mus)	Crossed eyes or squint - faulty muscle coordination	visual acuity visual attending	
trachoma (trak-ko-mah)	An infectious disease of the eyes, which is believed to be caused by a virus. It causes a chronic inflammation of the eye. The eyelid droops and affects the conjunctiva and cornea (the enter parts of the eye).	visual acuity visual attending	
	cannot form complete judgements of distance	Distance perception	
	cannot form complete judgements of spatial relations	Directionality Body awareness Perceptual constancy	

Learner Characteristics: Perceptual Abilities

Terminology	Characteristics	Areas of Development Affected by LC	Conditions for Atypical Characteristics
trachoma (cont'd)	can "see" four sides of a square; but cannot recognize them as an entire unit	Part whole discrimination	
	Unable to relegate ground and borderline incidentals to their proper position	Perceptual constancy Figure Ground	

Visual Acuity

Eichorn (1963) reviewed the normative data on visual acuity and presented a table of the longitudinal data in which she combined from several studies of visual acuity. This provides an approximation of the developmental trend in acuity. The slight discrepancies in the longitudinal data may be a result of measuring non-verbal infants, differences in techniques in measuring acuity and nonrandom samples.

Development of Visual Acuity

Age	Source of Data					
	Schwarting	Allen	Gorman et al.	Keeney*	Gesell et al.	Slataper*
Newborn			20/350-20/450			
4 months				20/235-20/335		
6 months	20/400					
9 months				20/235		
1 year	20/200			20/200		20/140 (Estimate)
2 years	20/100			20/40		20/48
3 years	20/50	20/40-20/50		20/30		20/42
4 years				20/20		20/40
5 years		20/30-20/35			20/25-20/30	20/33
6 years						20/27
7 years					20/20	20/26
8 years						20/24
9 years						20/23
10 years						20/22
11-13 years						20/20
14-15 years						20/19
16-18 years						20/18
19-54 years						20/18

*Data from these two studies have been converted to the 20-ft. notation (Eichorn, 1963).

From this table Eichorn notes that development of acuity is most rapid during the first two years, but not all of it can be accounted for at the retinal level. A marked increase in acuity occurs in the second year. Variables affecting this include differentiation of the macula at about four months, enlargement of the pupil at about one year and continuous maturation of the cortex throughout infancy.

Children should be carefully evaluated for visual acuity so as to diagnose problems as strabismus (faulty muscle coordination, e.g., crossed eyes or squinting),

nystagmus (rapid involuntary movement of the eyeball), amblyopia (dimness of vision due to disuse of the weak eye from improper muscle balance) or more common types of myopia, hyperopia, and astigmatism.

Measures for Visual Acuity

The following tests may be used to measure visual acuity.

National Society for the Prevention of Blindness, Inc., 79 Madison Avenue, New York, New York 10016. (Snellen E. and Letter wall charts; also test kit for Pre-School visual screening).

American Optical Company, Southbridge, Massachusetts 01550. (Sight Screener).

Bausch and Lomb Optical Company, Rochester, New York, 14602. (School Vision Test).

Freund Brothers, Atlantic City, New Jersey. (Atlantic City Vision Test).

GoodLite Company, Forest Park, Illinois, 60130. (The illuminated chart for use at 20 feet and at 10 feet, plus lenses, and the equipment for tests for muscle balance are produced separately).

Keystone View Company, Meadville, Pennsylvania. (New York School Vision Chart).

Titmus Optical Company, Petersburg, Virginia 23804. (School Vision Tester).

Ontogeny and Appropriate Equipment for Visual Acuity

Age in Months	Acuity Level	Appropriate Equipment
1	20/350-20/450	Good lighting
4	20/335	Minimized glare
6	20/335-20/400	Reduction in background contrasts
9	20/335	
12	20/200-20/140	
24	20/100-20/40	
36	20/50-20/30	
48	20/20-20/35	
60	20/22-20/35	
72	20/27	
84	20/20-20/26	

Visual Attending

Visual attention refers to the ability to direct and sustain attention to visual stimuli. It is a process which allows the child to screen out the influence of certain extraneous stimuli while bringing the effects of other stimuli into clearer focus. Attention is actually preparation for perception or a psychological selectivity which allows a child to select - or consciously react to - only those stimuli that are related to present needs (Rush, 1963).

Visual attending includes the developmental base of fixating, focusing, visual pursuit and scanning eye abilities.

Fixating refers to attending to a selected object versus staring vacantly at large masses without obvious preference.

Focusing is actually inspecting the environment by shifting the gaze, rather than just fixation on an object. For example, interpreting the symbol code (letters of the alphabet) of reading depends on the learner's ability to focus on a particular visual stimuli quickly without distorting or changing the structure of that perception.

Visual pursuit is the following or tracking of an object with the eyes. Focusing and visual pursuit combined are also known as scanning. Scanning involves eye movements that systematically examine various aspects of motionless objects within the visual field prior to figure-ground discrimination, as well as detecting and following moving objects.

Gibson (1966) specifies three types of scanning tasks: (1) the natural zigzag eye movements that occur as the child surveys his natural environment (focusing); (2) visual pursuit or tracking of moving objects; and (3) the learned, systematic scanning which is required for reading.

Early attending responses and orienting reactions provide the infant with his first sources of information about the world (Gibson, 1963). These reactions represent organized patterns of action which serve to select information on some adaptive basis around which future abstractions of environmental invariance must take place. Thus, the attending reactions of infants have been suggested to be necessary precursors of adult perceptual-cognitive abilities.

Research on attending abilities of the very young child suggest that the most prolonged periods of attention are likely to be elicited by reasonably complex stimuli to which the infant has not been previously exposed (Fantz, R.L., 1961, 1963, 1967). In addition, infants are likely to elicit longer fixations when presented drawings of the human face rather than designs (Kagan, 1967; Lewis, et al., 1966). The following variables have been identified as being significant when a child is faced with competing stimulus patterns (Hilgard, 1962): object of the greatest size; object with the strongest intensity; object most frequently repeated; object with most vivid contour, contrast or color. Change of the object's state also attracts attention, as well as novelty or that which is reinforced by persons in the child's environment.

Ontogeny and Appropriate Equipment for Visual Attending

Age in Months	Stage	Appropriate Equipment
1	Regards object in line of vision only (Watson and Lowrey). Follows to midline (Watson and Lowrey). Regards face. Eye and head movements not synchronized	Devices attached to string which move so infant can develop focusing and following
1.1	Momentary regard of object (Bayley).	Larger objects for younger child
1.2	Regards person momentarily (Bayley). Prolonged regard of object (Bayley). Horizontal eye coordination of object (Bayley).	Smaller objects as acuity sharpens and attending span lengthens
1.5	Regards cube (Bayley). Head follows dangling object (Bayley and Cattell).	
1.9	Follows past midline.	
2.0	Follows moving person (supine) (Cattell)	Mobiles, dangling objects, balls, spool on thread
2.5	Follows ball across table (Bayley). Regards raisin (Denver). Inspects own hands (Bayley). Regards object brought to mouth and then releases regard and looks out into space.	
3.0	Inspects fingers (Cattell)	Infants will fixate on objects that represent recently formed categories in the mind as well as moderate deviations of these schemata.
3.2	Eyes follow moving person (Bayley). Eyes follow dangling object in circle in supine position (Cattell).	
3.3	Horizontal eye coordination of light (Bayley). Regards own hand spontaneously.	
4	Eyes follow slowly moving object well (WWL). Regard goes from hand to object when sitting (W&L). Recovers rattle from chest in supine position (Cattell)	Fixation times are relatively low to stimuli that are very familiar and very novel

Age in Months	Stage	Appropriate Equipment
5.0	Regards pellet size object in sitting position (Cattell)	
5.3	Free inspection of surroundings (Bayley).	
5.5	Tries to maintain fixation of object brought to mouth. Releases regard with uncontrolled eye movements but can refix.	
6	Visually tracks through 90° in horizontal and vertical planes. Immediately regards a presented object reaches and grasps it. (Cattell). Reaches for second object (Cattell)	Peek-a-boo type games where child looks back and forth. This movement is slow at first. Child learns to do this quickly-focusing accurately at target. This refines over time with smaller and smaller objects.
7.5	Eyes follow object in pursuit (Bayley).	
7-16	Looks at picture in books	Picture books.
8	Begins to focus on details of objects (Cattell)	Later in he preschool years activities such as following a moving object, such as a tether ball, softball, and later tennis and ping pong balls.

Conditions to Develop Visual Attending

Activity: Touching a Swinging Ball

1. Learner Outcome
   a. To develop the visual perceptual ability to fixate or focus on an object and to follow it as it moves through space.

2. Conditions
   a. Learner Characteristics - appropriate for any child aged 3 or older who had normal vision and use of hand and arm.
   b. Situational Variables - in classroom or outdoors individual activity (one child with teacher).
   c. Strategy - Directive

Procedure:

1. Have child stand about an arm's length from the ball. Place his hand beside his shoulder with forefinger pointed ahead.
2. Swing the ball in front of the child. Let it swing naturally.
3. Tell the child, "Reach out and touch the ball with your finger as it comes in front of you. Keep your head still, and just watch the ball with your eyes".

4. Give praise if the child can follow the ball with his eyes and touch it.

If the child has a problem with this task, use the following procedure:

1. Leave the ball motionless.

2. Position the child's finger within an inch or two of the ball.

3. Leaving the ball motionless, gradually move the starting position back until he can thrust from his shoulder. Praise successful attempts.

4. Swing the ball through a very small arc and gradually increase the ball's movement.

d. Content - a rubber ball suspended from the ceiling or a tree limb on a rope.

3. Resource - Radler and Kephart. Success Through Play, p. 103.

The following activities are also appropriate to promote visual attending:

Eye Pursuit Movements
Helps develop smooth and continuous eye movements so child may learn to point his eyes at the place where he wants to get the most heightened meaning. (Essential for maximum success in reading and writing).

Felt cutouts; paper windmills, thumb tacks; flannel board; x-mas tree ornament; pencil
Look at the objects; name them with me. Hold your head still; move just your eyes.

At child's eye level, arrange felt figures (rabbit, duck, apple, orange) in a straight line across the board. Name objects in a left-right sequence. Move your head along the objects with a continuous movement.

Hold paper windmill in front of you. Watch as you move it slowly from side to side. Do not move your head. Let's count the times your windmill moves in front of you. 1-2-3-4-5.

Move x-mas tree ornament (tacked to a pencil) in an arc about 20" from eyes - move 15" to left and 15" to right.

Eye Movements - Near and Far
Help develop control of eye movements required for consistent visual information.

Hold your arms out straight. Look at your right thumb, left thumb, then at your right thumb without moving your head.

Visual Memory

Short term visual memory is the ability to retain a visual image for a short period of time. It may also be thought of as the ability to hold visual data in consciousness while scanning. The retina (a patch of neural tissue) most probably serves as the short-term memory. There is some agreement (Atkinson & Shiffria, 1967: Postman, 1964; Sperling, 1968; Waugh and Norman, 1965) that short term memory is short-term not because its neurons "remember" poorly but because every new stimulus overwrites the previous visual image or at least pushes it away from the force of memory.

Long term memory refers to stored visual information from past experiences. For example, long-term visual memory might contain the information necessary to recognize a particular face as familiar, even if no association can be made with it. A preschool child, for example, may recognize certain letters as familiar and still not be able to name them.

Without appropriate visual memory, perceptual constancy cannot be achieved because the child will be unable to develop those internalized, persistent schemata essential to visual discrimination and identification.

Visual memory is typically measured by showing the child a sequence of figures and then asking him/her to put corresponding chips of figures in the same order. In this sense it is the child's ability to reproduce sequences of nonmeaningful figures from memory.

Information regarding the developmental aspect of visual memory is all but nonexistent in the literature. Many of the tests for measuring visual memory also tap other skills such as verbal mediation or eye-hand coordination thereby confounding results even further.

Measures for Visual Memory. The following tests may be used to measure visual memory:

Colarusso, R.P. and Hammill, D.D. Motor-Free Visual Perception Test (MVPT) Academic Therapy Publications, California; San Rafael, 1972. Child views figure for 5 seconds and is shown a second picture to find it among several other figures.

Graham, F.K. and Kendall, B.S. Memory-for-Designs Test, Revised General Manual. Perceptual and Motor Skills. 11, 147-188. Requires child to reproduce a geometric figure from memory.

Kirk, S.A., McCarthy, J.J., and Kirk, W.D. Illinois Test of Psycholinguistic Ability. Revised edition. Urbana: University of Illinois Press, 1968. Subtest assess visual sequential memory by requiring the child to order a sequence of non-symbolic figures from memory.

Ontogeny and Appropriate Equipment for Visual Memory

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
24	Can locate an object placed under one of three boxes after a 10 second delay (SB).	Games that involve the hiding of objects such as Jack in the Box	Child's fine motor development should be advanced enough so as not to pinch fingers.
24-36	Can remember one or more pictures after being shown a picture and then asked to find it among several other pictures (Cattell, McCarthy & SB). Child reproduces sequence of 2 non-meaningful figures from memory after an exposure of 5 seconds (ITPA)	Matching games similar to "concentration" (i.e., visual discrimination matching cards sets)	Memory is advanced to remember 2 procedural uses for a toy (i.e., child in using a nail and hammer has to remember that he has to hold the nail one way while holding hammer another so as not to hit fingers. Pictures cut from magazines
36-60	Can remember two or more objects or pictures from memory (Cattell and McCarthy). Child reproduces sequence of 3 non-meaningful figures from memory after exposure of 5 seconds (ITPA)	Identify a missing object from a previously seen grouping (e.g., sequencing picture cards)	Picutres cut from magazines
60-80	Can remember three or more objects or pictures from memory (McCarthy). Child can reproduce sequence of 4		
80-102	Can remember four or more objects or pictures from memory (McCarthy).	Tachistoscope	

Conditions to Develop Visual Memory

Activity: Cursive Scramble

1. Learner Outcome: to increase visual memory of cursive alphabet

2. Conditions

   a. Learner Characteristics: children in the second grade - ages seven and eight;

   b. Situational Variables: groups of two or three children working alone or together;

   c. Strategy--Developmental

   Procedure:
   1. Construct a packet of cards with a cursive letter on each card;
   2. On the packet give directions that instruct children to put cursive letters in the order of the alphabet;
   3. Children may check their work by picking an answer card.

   d. Content: a packet to hold cards
   twenty-six cards with a cursive letter on each
   answer cards for immediate reinforcement

   e. Resources: none

Activity: Which Object is Missing?

1. Learner outcome: to develop visual memory skills

2. Conditions
   a. Learner characteristics: 3-6-year-olds;

   b. Situational Variables: in classroom group or individual activity;

   c. Strategy--Directive

   Procedure:
   1. Show tray of objects to the children. Tell them to "look carefully at all the things on the tray, because in a minute I'll take away one of the things, and I want you to tell me what is missing."

   2. Turn around so that the children cannot see the tray and remove one item.

   3. Show the children the tray, and let them tell what is gone.

   4. After the children learn how to play the game, they will enjoy being the "teacher" and taking an item off the tray for their friends to guess.

   d. Content: A tray containing several items that the children can name. (Use 3 or 4 items at a time with younger children, more items with older or more skillful children.)

3. Resources: none

Activity: Repeating patterns

1. Learner Outcome: to develop visual memory skills in order to sequence.

2. Conditions

   a. Learner Characteristics: 5-or 6-year-olds

   b. Situational Variables: individual or small group situation.

   c. Strategy--Directive

      Procedure:

      1. Place 3 squares of varying colors in a row. Instruct the child to make a "row like my row."

      2. Repeat procedure. Tell child to "think hard" because you are going to cover the squares. Do so and have the child complete a row from memory.

      3. If the child has difficulty he can be coached by having him repeat the colors from left to right; then close eyes and repeat them. While eyes are closed, cover and then have him make his row with eyes open but no other visual clues.

      4. Try same procedure with 4 squares.

   d. Content: any 8 objects which are identical in every aspect except color; two of each color.

Activity: Treasure Hunt (Visual-image)

1. Learner Outcome: to develop visual memory skills and the recognition and integration of visual stimuli in the brain and to recall past seen objects into a visual image.

2. Conditions

   a. Learner Characteristics: 6 to 10-year-old children of average (at Least) intellectual ability.

   b. Situational Variables: Not more than a 5 to 1 ratio.

   c. Strategy--Directive

      Procedure:

      Children are to make a treasure hunt for some other group of children or just one person. The hunt is to be composed of notes that describe locations for next notes in hints about room locations and objects in the room where the next note is hidden. To do this the children must remember the places of objects in rooms and the general room setting. Colors, shapes, and locations are to be emphasized. Two of the notes, at least, should be only maps of the room with a hint as to where the next note is. About 10 notes should be used before the "treasure" is found.

   d. Materials: some sort of "treasure" worth searching for, paper, pen, maybe magazines to include words or pictures for hints.

Perceptual Constancy

Constancy is the maintenance of physical properties of an object, figure or form. The physical properties consist of color, and the form elements of shape and size.

Constancy is the ability to be able to recognize shape in various sizes, shading, textures, and positions in space. This is the ability to perceive that an object has physical properties like shape, size, and position which do not vary in spite of the impression that they sometimes give because of distance, angle or light. For example, a car is perceived as the same size whether beside oneself or a half-mile away. Color can be perceived as the same whether in bright sunlight or a dull room. A child with difficulty in this area may be unable to recognize a known word in one context if it is presented in another form, color or size (Frostig, 1969). Environmental conditions that effect constancy include illunimation, viewing angle, distance and position.

Perceptual constancy enables the child the clear up ambiguous situations and determine what he/she sees. It also assists in correcting perceptual distortions. When a child cannot maintain a discrimination between figures such as "24" and "42", or "p" or "g", or three dimensional objects it is a constancy delay. Constancy is a learned skill that increases in terms of its accuracy as additional attributes of an object are added to the child's previous experiences. In a study by Gibson and Gibson when children were asked to make an identifying response to variations of a standard, children (6 to 8 years) made 46 percent errors, older children (8-1/2 to 11 years) made 27 percent errors and adults made only 11 percent errors. The specificity of the identifying response is less in the younger child than in the older.

Size constancy is the perception of the permanent or invariant sizes of an object at different distances from one. According to Thurstone (1944) and Roff (1953) perceptual flexibility has to do with form relationships. It is the ability to locate pictures that are the same size when presented together with pictures of several different sizes, or to see similarities in different situations.

Shape constancy is seeing the form or shape of an object as permanent and invariant in spite of changes inthe tilt or orientation of the figure. Soon after birth, the infant responds to differences in complexity of contour and shape. There is no age difference found in subjects from kindergarten to college in matching either identical shapes or different shapes by size. It appears then that shape discrimination appears soon after birth and improves rapidly. The early discrimination of the neonate is incomplete to the extent that she/he may focus on only one point of a triangle.

Color constancy is seeing the object as the same color in spite of changes in illumination.

Conditions of Constancy

Position. Ordinarily, a shape is considered to be upright when it is in its usual, or familiar, position in space. Braine (1973), however, has found that young children consistently make judgments of unfamiliar geometric shapes to be upright in one orientation and disoriented when turned 180° or 190°. She suggests that children's judgments are derived from mechanisms underlying perception of the shape, in particular from the directional processing of the parts of the shape.

Hence, when young children copy a rotated shape they will change it to the upright position. (These children may still have a tendency to be guided by cues upright in the bottom part of the figure.)

Between the ages of five and six there is a sudden increase in importance of form orientation. Thus, by the age of six, a child can identify the horizontal relations of "d" and "p", "g" and "k", and "p" and "b" although they may still have right-left confusions until the age of seven and a half with "b" and "d" and "p" and "a".

Distance. Some two-dimensional elements that create an impression of distance are:

relative size - the largest of two or more objects tends to be seen as closer;
interposition - an object that partially covers another is seen as closer;
texture - density gradiant - provides apparent difference in size and spacing of near and far objects. Relative motion plays a role in distance judgments in that when an individual moves, near objects appear to move more than further objects.

Viewing angle. The visual angle is the solid angle subtended by the target at the eye. In visual situations the target or object of focus has a visual angle - the object occupying varying portions of the visual field, depending on the angle. The following diagram indicates visual angle.

Visual angle plays a role in size judgments. In the absence of distance cues two objects which appear equidistant will appear the same size when they subtend the same visual angle (Epstein, Part, Casey, 1961; Holway & Boring, 1941).

Measures for perceptual constancy

The following test may be used to measure perceptual constancy.

Perceptual Constancy

Frostig, M. Developmental Test of Visual Perception. Consulting Psychologists Press, Palo Alto: California, 1966. This test consists of five subtests with developmental norms from 3 to 9 years of age:

1. Eye motor
2. Figure-ground
3. Constancy of shape
4. Position in space
5. Spatial relationships

Ontogeny and Appropriate Equipment for Constancy

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
2	Evidence of shape constancy (Bower). Size-evidence of size constancy (Bower).		Infant has not developed distance and could bring object too close to the eye injuring it when attempting to regard it.

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
6	Size - form judgments of size of 3 dimensional objects (Ling, 1941). Shape - can form judgments of shape of 3 dimensional objects and discriminate between various geometrical figures (Ling, 1941).	Sensory experiences with objects/equipment should be so child can classify on one dimension only (e.g. Baby Shapes)	
6	Distance - Child tends to seek object that is manually closer (Cruickshank, 1941).	Sets of objects that vary in color, shape, size, texture (e.g. colored mobile, rainbow twirler)	Push and pull toys should have durable handles
9	Distance - Stable differential responses to distance. Child will consistently reach for the nearer of 2 balls despite differences in size. (Misumi, 1951).		Size of objects to classify should be too large to get into the mouth
15-20	Position - Upright face received more recognition than in other position (Watson, 1966).		
24	Distance - Beginning to form relatively consistent judgments of the distance of objects despite the fact that child may be observing objects of various sizes in space, placed at a similar distance away (Bower, 1966a, 1966b). Position - Child is likely to look at figures, pictures, etc. upside-down as in the correct position.	Picture books	Objects should be smooth-edged or rounded so splinters or injury can't occur Because a child can visually discriminate and classify concrete objects doesn't mean he can classify concrete abstracts (i.e., all liquids are to drink - why many children drink poisonous liquids)
36	Viewing Angle and Position - Copies block design with demonstration 2 trials: 30 min. time limit (WPPSI)	Colored inch-cubes	
36-48	Position - Child can distinguish vertical lines from horizontal lines (Katsui, 1962)		
	Vertical dimensions are developed before left-right.	Objects to sort by size - larger, smaller - same size (e.g. cubes, pegboards)	

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
42-49	Viewing angle and position - copies block design two trials, 30" time limit (WPPSI).		
49-55	Position and viewing angle - can copy block design two trials with demonstration (WPPSI).	Give child piles of blocks of various shapes - have copy a picture or drawing with the blocks	
49-61	Position and viewing angle - can copy block design two trials, 30 seconds time limit with demonstration (WPPSI).		
60-84	Size - Size constancy reached (Kubznasky & Rebelsky, 1965; Wohlwill, 1963).		
61-64	Position and viewing angle - can copy block design two trials, 45" time limit with demonstration (WPPSI).		
64-70	Position and viewing angle - can copy block design two trials, 45" time limit (WPPSI).		
70-76	Position and viewing angle - can copy block design two trials, 60" time limit (WPPSI).		
72	Child generally evidences little difficulty in dealing with discriminations involving vertical, horizontal and oblique lines (Jeffrey, 1966; Rudel & Teuber, 1963).		
76-79	Position and viewing angle - can copy block design two trials, 60" time limit with demonstration (WPPSI).		
79+	Position and viewing angle - can copy block designs two trials, 75" time limit (WPPSI).		
84	Position - left-right dimensions developed. Ability to discriminate between "b" and "d", "p" and "g" and other asymetrical numbers and letters (Davidson, 1934, 1935).	Language boards with lower case letters, sandpaper letters	

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
120	Can intercept balls thrown from a distance.		

Conditions to develop constancy

1. Learner Outcome: to develop shape constancy

2. Conditions:
   a. Learner characteristics - preschool children and/or kindergarten.
   b. Situational variables - individual or group education.
   c. Strategy - directive

   Procedure:

   Facilitator tells child that they are going to play "Baker". Together they discuss what a baker is, what he makes, how he sells his wares, etc. Then the facilitator shows the child several different cookie cutters, all simple shapes and large enough to be easily manipulated by the child. Facilitator also shows child 2 different color of play-dough set on waxed paper and explains that, without mixing the colors together the child can play baker and make anything he wants. A rolling pin and a cookie sheet are also provided, and the hope is that the child will try to make cookies, rolling out the play-dough, cutting the shapes from the dough, and removing the shapes from the background of the same color. Any track he pursues will be acceptable, however, if it involves differentiating a shape from its background (making a "cake" and stamping decorations on its side, etc.). When the object is ready for the oven, facilitator and child will "bake" it and can "eat" it together.

   d. Content - 2 colors of play-dough, waxed paper, a rolling pin, cookie cutters (a star, a heart, a boot, and a bell), and a cookie sheet.

Activity: Fishing for Shapes

1. Learner Outcome
   a. To develop the visual-perceptual skill of shape constancy as well as eye-hand coordination.

2. Conditions
   a. Learner Characteristics - 3 to 6-year olds with normal vision and with normal use of arms.
   b. Situational Variables - in classroom: individual or group activity
   c. Strategy - Developmental

   Procedure:

   1. Spread on the floor geometric forms in a variety of sizes, colors, and textures. (With younger children use fewer and more easily distinguished forms.)

   2. Hold up a shape and ask the child to fish for a shape that matches this one.

d. Content:

1. Geometric forms cut from paper and cloth (cut 2 matching forms of each type).

2. Paper clips attached to one of each pair of forms.

3. Pole

4. Magnet attached to pole with string.

3. Resource - Croft and Hess. An Activities Handbook for Teachers of Young Children, p. 154.

Activity: Matching game

1. Learner Outcomes
   a. To develop shape and/or color constancy

2. Conditions
   a. Learner characteristics - 40 public school kindergarten children, many of whom do not know color or shape names.
   b. Situational variables - "free time" in the kindergarten.
   c. Strategy - Directive

   Procedure:

   1. Expose the materials on a table and encourage the children to practice matching before commencing any game.

   2. To directively teach the game:
      Hand out the boards and proceed in game-like fashion to pull shapes out of a box. The children have to keep alert in order to recognize the particular shapes that occur on their boards. When they realize that they have a match then the shape is given to them so that they may place it on theire.

   3. Gradually the game can be modified so that the children have to vocalize the color or shape or both in order to receive it.

   d. Content - one set of homemade boards with varying felt shapes of different colors glued on. There should be no identical pieces.
      Suggested shapes - square, triangle, rectangle, heart, diamond, circle, oval, star, cross, etc.
      Suggested colors - primary and secondary (if more than six shapes use more than six colors.

3. Resource - New Nursery School

1. Learner Outcome: to develop color and size constancy

2. Conditions:
   a. Learner characteristics - preschool and/or kindgarten children.
   b. Situation variables - individual or group situation.
   c. Strategy - development

   Procedure:

   Have buttons of different colors and/or sizes on table for child to interact with.

   d. Content - a box of buttons, varying in six different colors, three different sizes, and various shapes; six little cups and a tray for spreading the buttons out and sorting them.

Activity: Matching Fruit with Colors

1. Learner Outcomes
   a. To develop color constancy by matching

2. Conditions
   a. Learner characteristics - preschool-aged children
   b. Situational variables - individual activity within the classroom

3. Strategy - Directive

   Procedure:

   Show the child the pictures of the fruit. Say, "here are pictures of some of the fruit I think you may have eaten. Will you name the fruit for me? Do you know the colors of the fruit? Let's name the colors." Allow time for more verbal interaction. Then tell the child to take the color card and place it under the fruit of the same color.

   d. Content:

      1. 4 fruit cards (apple, orange, banana, grapes)

      2. 4 color cards (red, orange, yellow, purple)

In addition, activities similar to the following are appropriate for developing perceptual constancy ability:

Finding the same size. Give each child an object, such as a stick, a ball or a rock. Place other objects of the same shape, but of a variety of sizes, at various distances from the children. Some of these objects should be larger and some smaller than the ones they have in their hands, and some should be of the same size. Ask each child to identify the objects that are the same size as the one he holds.

Finding different sizes. Show children two objects of radically different sizes, and ask each one to point out the larger. Then show the children two more pairs, the difference in size between the objects in each pair becoming less with each pair. Some of the objects should vary only in height or in width or in depth, so that the child can learn to discriminate between differences in size when presented in each of the three dimensions.

Sorting according to size. A third size of object should be added to the pairs used in the exercise above, and each child should point out which is big, which is small, and which is medium size. Then broaden the range of sizes and ask each child to sort the objects into order according to size.

Finding the same shape. Show the children a geometrical form and ask each one to identify all the similar shapes in the room. If a rectangle is shown, the child might point out a tabletop, a door, a window, a book or a box.

Sorting according to shape: Objects of the primary shapes - triangle, square, circle - should be used to teach the recognition of square, circle, and triangular planes.

Exercises with two and three dimensional planes: Give the children piles of blocks of various shapes. Show them pictures or drawings of the same shapes and ask them to copy. Give the children pictures and show them corresponding blocks. When the children can match pictures and single blocks, make simple structures and objects from blocks, and ask children to indicate corresponding pictures. Objects such as roads, bridges, houses, beds, tables and chairs can be represented in a simple, schematic way.

Figure-Ground

The basic organization of visual perception appears to be figure and ground; that is to say the child recognize patterns as figures against a backgound whether or not the patterns are familiar.

From an organizational point of view, a visually perceived "whole" consists of a figure (that part of the total pattern most clearly perceived at a given moment) and the ground (the remainder of the perceptual field or the context).

According to Thurstone (1944) perceptual selection is being able to perceive shape against complex grounds. To understand the meaning of figure-ground perception and its importance, it is necessary to remember that we perceive most clearly those things to which we turn our attention. The brain is so organized that it can select a limited number of stimuli from a large mass of incoming stimuli. For example, we may hear cars outside, people in the hall, persons talking in the room and yet give our attention to an interesting speaker. From a visual standpoint, one may go into a room filled with many objects and persons, yet be conscious of only one or a few. Objects cannot be accurately perceived unless perceived in relation to their background. The child bouncing the ball cannot do so unless he/she can perceive where the ball hits the ground in relation to the body. Children with difficulty in this area may appear to inattentive and disorganized because their attention tends to jump to any stimuli presented.

When perceiving form, we know that infants perceive a globular form (a fuzzy perception of objects) without understanding the relationship of the parts. This perception develops until the infant perceives an integrated form (a perception of the whole) with the understanding of the relationship to the parts.

Measures for figure-ground. The following tests may be used to measure figure-ground perception:

Cobrinik, L. Hidden Figures Test in The performance of brain-injured children on hidden-figure tests. The American Journal of Psychology, 1959, LXXII, 5660571. Ages 6-11. There are three sets of ten stimulus pictures, plus one or two samples for each set. One set is called picture puzzles and is the usual type of hidden-figure puzzles seen in children's magazines. The second set of ten is the overlapping type of picture in which figures and background share points rather than contours. The type of item, called nonoverlapping, involves sharp contours of figures and background. On the overlapping and nonoverlapping the child is told to find one of four pictured objects within the masked condition. The picture-puzzle takes a while to find the given objects within the picture.

Graham, F.K., and Ernhart, C.B. Perceptual-Motor Battery. Ernhart, C.B., Graham, F.K., Eichman, P.L., Marshall, J.M. and Thurston, B. Brain-injury in the preschool child; some developmental considerations. II Comparison of Brain-Injured and Normal Children. Psychological Monographs, 1963, 17-33. Used with preschool children. Was originally designed to use with brain damaged children. Figure-Ground subtest1. This closely resembles the test developed by Strauss & Lehtinen for use with older brain-injured children. On this scale, the examiner requires the subject to identify thirty five objects from the Binet Picture Vocabulary which are embedded in distracting backgrounds. The stimuli are presented. The Mark-the-Cars subscale is similar to the Figure-Ground subtest in that the subject is to identify ten drawings of cars embedded in distracting background figures.

Also refer to Frostig's Developmental Test of Visual Perception discussed in "Measures for Perceptical Constancy."

Part-Whole. Involved in figure-ground discrimination is part-whole perception. Parts of a situation (or whole) tend to be perceived as belonging to a whole and the manner in which the whole gestalt is perceived will influence the perceived meaning of the parts. In a series of studies Elkind makes reference to Piaget's view that the perception of a child is "centered" in the sense that its organization is dominated by "field effects." With age and development of new mental structures the perception of the child is progressively freed from its domination by field effects and becomes increasingly logical in form. One study in particular found age-related changes in children's perceptions of part-whole figures, such as "a man made out of fruit." The results indicated that 4-5 year olds usually saw only parts, 5-6 year olds saw only wholes, and 6-7 year olds saw part-whole combinations (Elkind, et.al., 1964).

Ontogeny and Appropriate Equipment for Part-Whole Perception

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
24-72	Can identify parts of body on large paper doll.	Rag doll	Objects should be of solid construction for younger child as child centers on parts and will pull, push, twist until it usually comes off.
36	Can identify what parts are missing in a mutilated picture. This develops in difficulty (WPPSI, Cattell, S.B.)	Pictures with hidden figures, body puzzles, homemade puzzles.	
48-60	Separation of part-whole. Report receiving only the parts from which the total drawings were constructed (Elkind, et al., 1964).	Halves to whole puzzles. Simple backdrops with 3 dimensions - then 2 dimensions - Child learns to select important features from scenes or pictures	Toys should be kept simple in construction with only one major part for very young children and then increasing in complexity.
84	Children alternate in their organization of figures (Elkind, et al., 1964). Increased accuracy and speed in selecting letters from complex backgrounds (Gibson, 1966).		Child could be focusing on a part and fail to see the danger in another part of the object (i.e. something protruding)
96	60% of children perceive both wholes and parts at the same time.	Color by number pictures	
108	78% of children perceive both wholes and parts simultaneously.		
120-156	Capacity to identify embedded figures in complex designs (Line, 1931).	Typewriter	

Conditions to Develop Part-Whole Perception

Activity: Making a puzzle and putting it together

1. Learner outcome: to develop ability to distinguish relationship of parts to whole.

2. Conditions

   a. Learner Characteristics: 7-9 year olds

   b. Situational Variables: small group situation

   c. Strategy: Directive

      Procedure:

      1. Distribute piece of cardboard, crayons and scissors to each child.

      2. Discuss drawing a picture of child's favorite story that covers entire piece of cardboard.

      3. Instruct child to cut finished picture into 15 pieces and scramble them.

      4. Then ask child to put the puzzle back together.

   d. Content--cardboard, crayons, and scissors.

   e. Resources--none

Activity: Finding the Missing Part of an Object.

1. Learner outcomes:

2. Conditions

   a. Learner Characteristics: Four to eight year olds, depending on the child's ability.

   b. Situational Variables: No more than four children.

   c. Strategy: Directive.

   Procedure: The child is presented with a complete picture of an object, and is instructed to identify it and look at it for a short time. Then this picture is replaced by a similar one with one part of the object missing; the child is to identify the missing part. If necessary both cards will be presented at the same time to facilitate the task until the child can comprehend what she is to do.

   d. Content: The materials include pictures of common objects familiar to the child (e.g., cup, chair); two pictures of the same object will be made identically, except one will have some part of it missing.

Visual Closure. Visual closure is the ability to adequately anticipate or supply missing unusual elements when presented with an incomplete stimulus. It allows the child to perceive a part of an object (inadequate or incomplete sensory data) and to fill in the missing parts so that the object is perceived as complete. Adequate visual closure implies the ability to anticipate and supply missing visual elements by utilizing contextual clues. Measures of closure include the ability to locate a simple figure embedded in a more complex one (flexibility of closure), and the ability to identify a familiar but incomplete object (speed of closure). Developmentally, the fewer clues the child needs for verbal identification the more developed is his visual closure.

By ages four and five, children have no trouble in tracing overlapping figures. Up to the age of six, they may not recognize pictures presented singly but in the form of dashed contours. The child will probably be seven before he can perceive pictures made of dashes and superimposed.

Ontogeny and Appropriate Equipment to Develop Visual Closure

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
24-36	Child can identify 6% of 58 hidden figures (ITPA)	Identify missing parts and talk about how missing part contributes to the whole.	
36-48	Child can identify 15% of 58 hidden figures (ITPA)	Puzzles begin with 2 or 3 pieces that deal with parts to whole. Increase in difficulty.	
48-60	Child can identify 25% of 58 hidden figures (ITPA)		
60-72	Child can identify 32% of hidden figures (ITPA)	Dot-to-dot pictures encourage child to try to indicate what the picture is at various points before all the dots are connected.	
72-84	Child can identify 40% of 58 hidden figures (ITPA)		
84-96	Child can identify 48% of 58 hidden figures (ITPA)		

Conditions to Develop Visual Closure

Activity: Hidden Figures

1. Learner Outcome - To develop visual figure-ground differentiation.

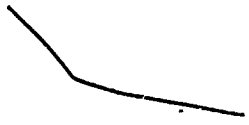
2. Conditions
   a. Learner Characteristics - 5-6 year olds
   b. Situational Variables - individual or group situation

c. Strategy

Procedure:

Place 1 picture at a time in front of students and ask to locate, trace and color in particular figures within the pictures. Teacher begins with simple ones and then proceeds to more difficult ones, according to how the child is progressing.

d. Content - homemade pictures such as



Activity: Picking out letters and numerals on superimposed figures

1. Learner Outcome - To develop figure-ground perception

2. Conditions
   a. Learner Characteristics - appropriate for children who have normal vision who already know capital letter names, numerals up to 10, and geometric shapes (circle, triangle, square).
   b. Situational Variables - classroom activity for an individual or small group.
   c. Strategy - Directive

   Procedure:

   1. Figures are superimposed, one on the other, partially but not completely. For emphasis they may be outlined in different colors. Letters or numerals are placed in different parts of the design made by the superimposition. The child is asked to pick out letters or numerals in one or both of the figures. In a more difficult task, three figures are superimposed and the child does the same thing.
   2. More specifically, the teacher asks the following questions pertaining to figure 1:
      Which letters are in the circle but not inside the triangle?
      Which letters are in the triangle but not in the circle?
      Which letters are in both the triangle and the circle?
      Which letters are not in either the triangle or the circle?

      The questions pertaining to figure 2 are:
      Which numerals are in the circle but not in the square?
      Which numerals are in the triangle but not in the circle?
      Which numerals are in the circle, triangle and square?

d. Content - enlarged figures like the following:

figure 1

figure 2

3. Resource - Behrmann, Polly. Activities for Developing Visual-Perception. Academic Therapy Publications, San Rafael, California, 1970.

Activity: Hidden Pictures

1. Learner Outcome - To develop ability to perceive figure-ground relationships.

2. Conditions
   a. Learner Characteristics - 3-6 year olds, with normal hearing and vision.
   b. Situational Variables - individual activity with teacher.
   c. Strategy - Directive

   Procedure:

   1. Show the pictures one at a time to the child.
   2. Tell the child that there is a picture of a (specify) hidden in the big picture. "Look very carefully and show me the picture of the _____."

   d. Content - pictures containing hidden pictures

Perceptual Discrimination

Perceptual discrimination is the ability to recognize the likenesses and differences between pictures or objects.

To perceive form at all, an individual needs to perform the following basic perceptual tasks: a) eye movement, b) detection of form, which merges also with such concepts as brightness, c) discrimination, which is limited by visual acuity, and d) scaling, a more complex task than discrimination but basically related. Scaling relies on perception of similarity, complexity, meaningfulness, and other dimensions.

Once form is perceived, it is put into the mind by 1) the recognition and identification of the form; 2) the imaginative construction of the form; and 3) the association of the form with things that the form was not intended. These last two are affected by the individual's past experiences and the stimulus variables of the form. Children learn to identify familiar 3 dimensional objects first, then the differences between them and later 2 dimensional objects.

Factors of concepts of shape, color, number, arrangement, and size are involved in this discrimination process (Thurstone, 1944). Gibson (1963), describes this skill as detection of distinctive features. It is learning to detect differences, and discovering ways in which each figure is unique, or different from other members of the set.

In terms of reversals of figures if a child cannot tell the difference between p and q, there is a discrimination problem; if he/she can tell the difference, but cannot maintain it, there is constancy delay.

Infants show marked changes in visual preferences during the early months of life, especially when different patterns are shown to them. Hagan (1967) suggests that objects of intermediate complexity and intermediate brightness are preferred to objects that are extremely complex in design, too bright, or insufficiently illunimated. Children show a preference for color over form between the ages of 3 and 6, and a preference for form over color after 6 years of age (Brian and Goodenough, 1929; Corah, 1964; Suchman & Trakasso, 1966). Berich (1970) demonstrated that children prefer form over colors and borders.

Measures for perceptual discrimination

The following test may be used to measure perceptual discrimination:

Elkind, David. Elkind's Ambiguous Pictures. Ages 6-11. Document No. 8154 from ADI Auxiliary Publications Project, Photoduplication Service, Library of Congress, Washington, D.C. 20540. The Ambiguous Pictures Test consists of two sets A and B of seven black and white ambiguous pictures mounted on 8 x 11-1/2 inch tag board sheets. For one set of pictures shields are available which when placed over the picutre, make the object clearly recognizable. The objects are common ones like cat, tree, leaf, face, and so forth.

Ontogeny and Appropriate Equipment for Perceptual Discrimination

Age in Months	Stage	Appropriate Equipment	Potentially Hazardo Conditions
1.5	Visually recognizes mother (Bayley). Glances from one object to another (Bayley).	Posters and bright pictures	

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
1.5-1.9	Smiles responsively (Bayley).	Mirror	
2-6	Aware of strange situation (Bayley).		
3	Seeks novel visual experiences.		
3-8	Discriminates strangers (Bayley). Picks longer line 3 of 3 (Bayley).	Containers for water play, string, cord, yarn	
36	When presented with stimulus picture of an animal can point to identical animal on page of several animals (S-B).	Visual discrimination matching sets, picture books.	
54	Visual preference for 2 dimension color and form over form-texture (Siegel, 1973).	Sorting boxes or rods with objects to classify by 2 dimensions.	
78	Visual preference for dimensional form and texture over form-color (Siegel, 1973).		

Conditions to Develop Perceptual Distrimination

1. Learner Outcome: to develop perceptual discrimination of one object from a field of many similar objects.

2. Conditions:
   a. Learner characteristics - 4-6 year olds
   b. Situation Variables - individual or small group situation
   c. Strategy - directive

   Procedure:

   Spread several different kinds of beans in random fashion on a piece of black construction paper. Talk about beans - what they are, what we use them for, what they taste like, what they look like - with the child. Then pick up one kind of bean and put it into a section of a muffin tin and ask the child to find other beans that look like the first bean and put them into the same section of the tin. Repeat with at least 2 other kinds of beans. Upon successful completion of this task the child may make a bean picture by spreading glue onto the construction paper and dropping the beans onto the page as he likes.

   d. Content - black construction paper, a muffin tin, Elmer's glue, red lentils, green lentils, soybeans, popping corn kernels, and chick peas - all large enough for a child to grasp easily.

3. Resource - Karnes' Helping Young Children Develop Language Skills.

Activity: Differences in objects

1. Learner Outcomes
   a. To develop the ability to make fine discriminations between objects which are very similar.

2. Conditions
   a. Learner characteristics - kindergarteners, age 5, with a wide variety of cognitive, social, emotional and motor skills.
   b. Situational variables - group activity (small group) within the classroom.
   c. Strategy - directive

   Procedure:

   1. Present to children four or five objects. Start with objects with obvious differences, proceeding to the less obvious. Place the different objects in different places, so child doesn't use position as a clue.
   2. Say, "I have some cards with pictures on them. On each card all the shapes will be the same except one. I would like you to see if you can find the one that is different (or begin by saying "not the same as" the others) and tell why it is different. *With a nonverbal or child who cannot express himself adequately you can make the activity a receptive language activity. Example: Point to the shape that is different. Show me what is different about this picture.

   d. Content - strips of cardboard 4" x 20" on which have been drawn four or three identical objects and one which is different. Or, actual objects could be used in the initial stages such as 4 red blocks and one blue block (all of the same size).
      Examples: three cats sitting down and one lying down
      three balls with strips and one without
      four houses with chimneys and one without
      four squares and one circle
      four balls and one bat
      four triangles and a fifty upside down
      four cups with handles and one without a handle
      three b's and one d
      four hats with feathers and one without
      and so forth , . . let the imagination be your guide
      *Caution: begin with objects, shapes, colors that the children are familiar with so the difference is obvious

3. Resource - An Activities Handbook for Teachers of Young Children by Hess and Croft, p. 24.

Activity: Dominoes

1. Learner Outcome: to develop the ability to recognize similarities and differences in objects.

2. Conditions
   a. Learner characteristics - preschool and/or kindergarten children
   b. Situation variables - small group situation

c. Instructional strategy - directive

Procedure:

All the dominoes are placed face down.
Each player takes 7 dominoes to make up his hand.
The first player takes one from his hand and places it face up.
The next player takes one of his dominoes that matches one of the pictures on the first domino and places it end to end, end to side, or side to side.
If he cannot make a match, he draws from the face down dominoes until he can play. If there are no more dominoes to draw, he misses his turn.
The winner is the first player to play all of his dominoes or have the smallest number left.

d. Content - Creative Playthings Picture Dominoes

The pictures consist of the following: a flower, a bird, a fish, a ladybug, a butterfly, a snail, and a turtle. Three different colors are used: green, yellow and blue.

Activity: Puzzle Patterns

1. Learner Outcome: to develop perceptual discrimination of patterns.

2. Conditions
   a. Learner characteristics - 1st graders
   b. Situational variables - individual or group situation
   c. Strategy - directive, later developmental in learning center

Procedure:

1. On cardboard, paste simple patterned pieces of paper (2" x 5").

Example:

2. Have a matching piece of each placed in a small envelope.
3. Show patterns and discuss their designs. Ask the child to slide each of the larger pieces under the matching puzzle square so that the design is exactly lined up.

Example:

d. Content - homemade patterns on tagboard.

Activity: Printed name puzzle

1. Learner Outcome: to develop perceptual discrimination by using printed names.

2. Conditions
   a. Learner characteristics - kindergarteners, age 5
   b. Situational variables - group or individual activity
   c. Strategy - directive approach

   Procedure:

   1. Provide envelope for each child with his name printed on the outside.
   2. Place letters of child's name inside each envelope, e.g. W E S.
   3. Say, "Here are some letters which can be used to make your name". Demonstrate with a child's name. "We will start here at the left-hand side and move to the right. Who can help me find the big _____ (first letter of the name), and place it under the one on the envelope?"
   4. Continue to complete the name.
   5. Mix up the letters and let several children make the name.
   6. Give each child his envelope.
   7. Tell them they may make their onw name and that you will help.
   8. Later each child can learn his last name in the same manner.
   9. When a child can easily copy his name, show him the card and ask him to make his name from memory.

   d. Content - envelope for each child upon which is printed his name; and those cardboard letters needed to make his name.

3. Resource - Hess and Croft. A Handbook for Teachers of Young Children, p. 33.

Depth Perception

Depth perception is the fusion in the brain of slightly unlike images of the eyes. The perception of an object in the right eye is seen at a somewhat different angle than the perception of the object in the left eye.

At six months depth perception is evident when a child who is able to crawl, (Walk, 1961; Gibson, 1960), will not move over a "visual cliff" formed by clear glass that was an extension of a high table. From investigations with the very young child to adulthood it becomes apparent that judgments concerning the relative placement of objects within the distant space field are relatively independent of those involving depth (the relative closeness of two or more objects to the observer). Depth perception, then, is how one sees three-dimensional space. According to Baird (1963), the differentiation seems to occur during late infancy and early childhood. Smith (1965) notes that nursery school children seem dependent on perception of depth rather than distance in their play activity in that the sizes of nearby objects are judged in terms of the child's manipulative capacities, while distances immediately adjacent to the child are scaled in units corresponding to his/her movements, such as two steps away.

According to Gibson (1963) solid objects which possess depth at their deges are discriminated at an earlier age than two-dimensional pictures or line drawings. This is because the solid objects possess more attributes by which the child can identify the object from another. Therefore Gibson suggests that what is learned is isolation from background or differentiation rather than associative meaning for depth. A two dimensional element that creates a depth illusion is the result of linear perspective--the greater the convergence of lines, the greater the impression of depth.

Movement Perception

There are two major forms of perception of movement. The two main classes are the experiences of the person's own movement and movement of something external to the person. To produce the visual experience of movement, some kind of spatial change in the retinal image must be produced over time. Temporal sequences of events must occur on the retina. The two major types of movement external to the person are movement of perceived objects in motion and perception of apparent movement without target displacement.

Physical factors such as intensity, position, and timing substitute for the usual displacement in apparent movement (Gibson, 1969; Kidd and Rivoire, 1966; and Wohlwill, 1960). Although visual movement perception has been studied in its developed state, little information exists as to the developmental sequence of movement perception. Most studies showed that with increasing age the temporal range of apparent movement between perceived simultaneity and perceived succession decreased. One investigator, Pollack (1966) found a temporal range of apparent movement decreasing from 6 years of age to 9 years and then increasing up to age 11. At birth, perception of movement when more than one object is present is not adequate. Children are unable to coordinate motor efforts when attempting to deal with rapid movement in their spatial field. By six months of age children begin to form judgments of speed.

According to many investigators (e.g. Piaget, 1969; Zapparoli and Reatto, 1969; Fairbank, 1969; forgus, 1966), the processes involved in the perception of apparent movement are related to the larger problem of perceptual organization. It is quite

likely that the variables affecting perceptual organization also influence the perception of apparent movement. Rock and Ebenholtz (1962) and Vernon (1952) state that past experience, learning, and set influence the perception of apparent movement. Segal and Barr (1969), however, found that cognitive style was most influential. With regard to attentional factors, Lewis and Baumel (1970) found color to be a significant stimulus dimension with 3- and 4-year-olds.

Body Awareness (Body Image)

This is the concept that an individual has of his/her own body as a result of subjective experiences with the body and how they are organized. Some authorities view body image as a global concept encompassing all the movement capacities as well as sensory impressions created by these movements (Cratty, 1970). Benton (1959) refers to three elements which are necessary to the formation of body awareness, beginning in early infancy: the integration of sensory information, learning, and symbolic representation. Impairment in any one of these three elements can be expected to produce a lag in the development of body awareness. Bender (1956) has emphasized that body image is needed before a child can imitate movements, and thus develop motorically.

Barsch (1968) postulates that development of body image follows the cephalocaudal sequence of general motor development, that is, the head to tail sequence. Thus the child first acquires an awareness of the head, then the shoulders, torso, pelvis, legs, and feet (in general, the awareness follows use of these parts). Barsch also suggests that development follows a proximal-distal rule, with awareness of body parts near the midline coming before awareness of end members of the body.

Anthony (1971) further differentiates the development of body image. He suggests that because feeding is the infant's primary activity, the mouth is the first center of perception, followed by eyes, ears, and hands. Once the infant can coordinate these various body parts, it is possible to explore the rest of the body and further develop body awareness. This view of development is not contradictory to that proffered by Barsch.

There is little doubt of the general acceptance of the concept that each individual does develop an image of his/her body. How this can be measured is an entirely different issue. There is some controversy over the best way to determine a child's body image. Some measure it by having the child draw the human figure. Any distortion of details, omission of parts, variations in size, differences in emphases, are thought to reflect a state of confusion in body image of drawer. This method of evaluation is subjective and, therefore, controversial.

Another method of measuring body image consists of requiring the child to verbally label body parts or to identify them by pointing. Thus any inaccuracies in labeling or pointing is attributed to body image distortion. What is not considered is the language deficiency that might also reveal itself in similar inaccuracies.

Kephart (1960) suggests behavioral criteria by which a child with body image problems can be detected.

A child who selects a space on the floor that is too small for the task defined (or vice versa) indicates an imperfect awareness of the space occupied by his body in various positions.

In activities which require children to move various parts of the body upon command, a child with body image problems may not be able to move one arm without moving the other arm.

A long hesitation before the child moves a designated parts also may be indicative of problems.

There are generally thought to be four broad categories of body image distortion.

These include:

Feelings of the loss of body boundaries which involve a sense of blurring of the demarcation line between one's own body and that which is outside one's body.

Sensations of depersonalization which revolve about a perception of one's body as strange or alien.

Attributing to one's body of unrealistic qualities and extra parts.

Confusion regarding the distinction between right and left sides of the body (related to Laterality).

Laterality and directionalty both contribute to an individual's body image and, thus, must be considered as part of the total development of body image and not as distinct entities.

Measures for body awareness. The following tests may be used to measure body awareness:

Harris, D. B. Goodenough-Harris Drawing Test. Harcourt, Brace & World, Inc. New York, 1963.

Kephart, N.C. The Slow Learner in the Classroom, Columbus Ohio: Charles E. Merrill Publishing Co., 1960.

The Identification of Body Parts section of the Perceptual Survey Rating Scale provides a measure of the child's awareness of the body parts, their names, and their precise location.

Tactual-Localization Test, adaptation of Bender's Face-Hand Test (1953). In this test objects in the environment, a part or 2 parts of the child's body are touched and the child is asked to identify the object or body part which has been touched. This test detects body image difficulties.

Ontogeny and Appropriate Equipment for Body Awareness

Age in Months	Stage	Appropriate Equipment	Potential Hazardous Conditions
0-24	Identifies gross body parts verbally. "tummy," back, arm, leg (Cratty, 1967).	Large dolls.	
3	Separation of "I" from "Not I," (Anthony).		
8	Recognition of "I" (Anthony).	Mirrors-small and full-length.	Sharp edges or breakable material.
15	Development of observable self (Anthony).		
24-36	Aware of front, back side, head, feet. Can locate objects relative to these body references (Cratty).	Games that require directed movement. (eg. motor expressive language cards).	

Age in Months	Stage	Appropriate Equipment	Potential Hazardous Conditions
39-62	Identifies body parts by touching. Draws a man 3 parts (Denver). Imitates movements in angels in the snow (Kephart).	Simple puzzles of human figures or animals that show functional portions of the body. Dolls with moveable parts and clothes.	Weakly attached parts connected with sharp pins or needles. Small removeable parts that might lodge in throat or be swallowed.
42	Turns sidewise to adjust to narrow opening.		
48	More aware that there are two sides to body, more detailed awareness of body parts.	Matching cards with facial expressions, or body parts. Games which ask child to imitate movements or which encourage creative movement.	
54-72	Draws a man 6 parts (Denver).		
60	Clenches the teeth and shows them by parting the lips on request (OT). Can locate self relative to objects, and objects relative to self (Cratty, 1967). Trunk in drawings (Cratty, 1967).	Obstacle courses with tunnels, walking beams, and other equipment of various depths, shapes, and sizes.	Plastic material should be non-flammable, solid structures with no nails on which child could catch self while going through or under something. Smooth edges to prevent cuts or tears.
72-108	Shows hestancy in identifying more than one body part (Purdue).	Body puzzles.	
84	Can knit eyebrow (OT).		
84-96	Facial expressions appear in figure drawings; more details (Cratty, 1957).	Face puzzles	
96	Aware of posture in himself and others. Very dramatic in activities with characteristics and descriptive gestures. Can wrinkle forehead (OT).	Games which encourage dramatic characterizations, such as charades. Dress up clothes.	
96-120	Slight hesitation or confusion in identifying body parts, but steadily improves with age (Purdue).		

Age in Months	Stage	Appropriate Equipment	Potential Hazardous Conditions
108-120	Can describe arrangement of objects from another perspective (Cratty, 1967)		
120	Closes eyes alternately.		

Conditions to Develop Body Awareness

Activity: Creative Movement

1. Learner Outcome

   a. To develop increased awareness of the body in space.

2. Conditions

   a. Learner Characteristics--Kindergarten class.

   b. Situational Variables--Group or individual activity inside or outside.

   c. Strategy--Developmental

      Procedure:

      Play a recording and suggest children dance in and around cardboard cartons which you have placed in room. Say: "We all need space to move. Move into a small space." Say: "When you are in a small space, you make small movements. Show me how you moved when you were inside the box. When you are in a large open space, you can make big movements. Show me how you moved when you had lots of space.

   d. Content--large and small cardboard containers.

   e. Resource--An Activities Handbook for Teachers of Young Children, Hess and Croft, New York: Houghton-Mifflin Co., 1972, p. 12

Activity: Creative Movement

1. Learner Outcome

   a. To develop body awareness.

2. Conditions

   a. Learner Characteristics--Appropriate for children ages 2 to 6.

   b. Situational Variables--Classroom activity for an individual or a small group.

c. Strategy--Directive.

Procedure:

1. Have the children sit on the floor around the teacher.
2. The teacher holds a rag doll with both hands and shows the children how limp it is. She shakes it gently and calls their attention to the way its head, legs, and arms hangs loosely.
3. Tell the children to shake their hands and arms and let them hang limp. Do the same with heads and bodies.
4. Play music and have the children move aroud the room pretending to be rag dolls.
5. Have the children lie down. Go around to each one and lift his arms and legs and let them drop gently, saying: "Feel like a rag doll. Make your arms and legs heavy and floppy".

d. Content--one limp rag doll, and recording of slow quiet music.

e. Resource--Croft, Doreen J., and Hess, Robert D., An Activities Handbook For Teachers of Young Children, Houghton Mifflin Co. Boston, 1972.

Activity: Learning and Locating Body Parts and Feeling Rymthm of Song.

1. Learner Outcome

a. To Increase body awareness by participating in song, "Hey Everybody".

2. Conditions

a. Learner Characteristics--Age 7 to 9 (applicable K+)

b. Situational variables--group activity.

c. Strategy--Directive.

Procedure:

1. Go through the words and tune and do the motions with the group slowly at first. As time goes, one of the group can select the direction to be given and lead the song:

d. Content--Can be extended to more active directions also.

Hey everybody (touch your toes repeat 2 times)
Hey everybody (touch your toes 1 time)
Hey everybody (touch your toes repeat 2 times)
Hey everybody (touch your toes 1 time)
Touch your - ears, head, knees, ankles, elbows, abdomen, chest, spine, neck, chin, cheeks, teeth, nostrils, thigh, calf, earlobes, etc...
Last verse:
Hey everybody, sit right down.

e. Resource--Song, "Hey Everybody", from Language Concepts Through Song.

1. Learner Outcome: To develop body awareness.

2. Conditions:

   a. Learner characteristics: 4 to 7 year olds.

   b. Situational variables: individual.

   c. Strategy: Directive, with some developmental.
   Procedure:

   Discuss what the child looks like, how many arms and legs he has, what he is wearing. Then ask child to lie down on a piece of brown paper and trace around his body with a felt-tip pen. Present the child with a bag of scraps of cloth and construction paper, some glue, some scissors, and some crayons and tell child that he can "decorate" the outline however he chooses. No further directions are given, and it is at this point that the lesson becomes developmental. While it is hoped that the child will use the scraps of cloth to dress the figure in some way, however he uses the materials is acceptable.

   d. Content: a long piece of brown paper, a felt-tip pen, crayons, scissors, scraps of cloth and construction paper, paste.

Activity: Mystery Man

1. Learner Outcome: to develop body awareness.

2. Conditions

   a. 6-8 year olds.

   b. Situational Variables--group activity.

   c. Strategy--Directive.

   Procedure:

   The children were told which part of the man they were to make. No instructions were given as to how it was to be made, in other words, they were creatve in the context given.

   d. Content--paper, crayons, scissors.

The following activities are also appropriate to develop body awareness:

Imitation of Movement: Imitating simple arm and let movements demonstrates control of body limbs and ability to translate a visual pattern into a motor pattern. Look at me and do as I do - extend right foot, left foot, etc.

Learning Right: Put masking tape on right hand. Raise your right hand. Put your right hand on your head. Raise your right foot; jump 3 times on your right foot.

Angels-in-the-Snow: Becomes aware of his extremeties and their position in space relative to his body. He makes movements in time sequence or rhythms - helps to gain good bilateral control in which each side maintains its independence but in integrated with the other.

Stepping Stones: Eye-foot coordination--laterality and directionality are both developed.

I am going to mark your feet (tape) the same color as these squares (card board) with black on your left foot and red on your right foot.

Put your foot with the black mark on the first square. Now your foot with the red mark on the next square. Walk on all of the squares; black foot on black square; red foot on red square. Don't skip any or go back.

Animal Walks: Requires body to assume different positions and functions.

Can you walk like an animal?
Puppy Dog Run: Run forward on hands and feet
Bear Walk: Walk on hands and feet; move arm and leg on same side of your body at the same time
Duck Walk: Squat down. Raise your elbows outward and walk forward.

Obstacle Course: Helps child to be aware of space needed to accomodate his body.

Laterality

Laterality is defined as the awareness, or perception, an individual has of right and left gradients within his body. The right and left sides of our bodies are two independent systems. All nerve systems innervating the left side of the body are distinct, going through the spinal cord, crossing into the brain stem, and entering the right hemisphere of the cortex. Laterality, therefore, is learned by experimenting with both sides of the body, by observing the differences between these movements, and then by comparing these differences in sensory impressions. Thus certain qualities of movement are ascribed to the left side of the body while other qualities are ascribed to the right side of the body (Kephart, 1960).

The development of laterality helps the child to keep things straight in the world around him since the only directions an individual has are based on relation of objects to his/her body. Laterality develops primarily out of balance. A child becomes aware of his/her left and right by innervating one side of his body against the other, and executing the appropriate follow-up movement so that balance is not lost.

Problems in laterality may arrest a child's further development. There are two important stages at which a child's development can stop (Kephart, 1960). The first of these stages is revealed in the bilaterally symmetrical child. This child's movements andresponses are organized so that both sides of the body are performing the same act at the same time. The child's motor development revdals no concept of laterality. Motor responses are generally imitated with both sides of the body. The second stage at which development of laterality may stop is seen in the unilateral child. This child, unlike the former, becomes almost completely one-sided. In every activity, he/she merely drags along the other side. When this child is required to perform bilaterally, one side usually leads the other, without any real cooperative effort of both sides in the activity.

It is important to note that while both of these stages are appropriate in a normal developmental sequence, a child's development may be arrested in either stage and thus affect later perceptions of objects in relation to self as well as the relation of objects to each other. In this sense, then, undeveloped laterality may lead to a multitude of hazardous situations throughout one's life.

Measures for laterality. The following tests may be used to measure laterality:

Benton, A.L. and Cohen, B.D. Right-Left Discrimination and Finger Localization in Normal and Brain-Injured Subjects. Procedures of the Iowa Academy of Science, 1955. This test measures the ability of children and adults to discriminate between right and left. There are two forms of the test: Form A with thirty-two items, requires the subject to execute "localizing movements" on co-mand. It assesses six aspects of right-left discrimination, the specific tasks being as follows (Benton and Cohen, 1955):

With the eyes open, pointing to single lateral body parts.
With the eyes open, execution of double crossed and uncrossed commands.
With the eyes closed, pointing to single lateral body parts.
With the eyes closed, execution of double crossed and uncrossed commands.
Pointing to lateral body parts on a schematic, frontview representation of a person.
Execution of double crossed and uncrossed commands involving lateral body parts of both the subject and the schematic representation.

Benton, A.L. Right-Left Discrimination and Finger Localization. New York: Paul B. Hoeber, Inc., 1959. Form A: Child is required to perform localizing movements. Tests require some language comprehension but no verbal response. Form V: This form is similar to form A except that verbal responses are required. A discussion of normative data from both tests is provided.

Trankell, A. Impulse-Scale, for children ages 7-10 ½. Measure of laterality. The Impulse-Scale consists of twenty items of which the following are characteristic: pick up an eraser; catch a ball; cat with scissors; pour water; shoot marbles; use a screwdriver; use a hammer; kick a ball; throw a ball; and hop on one foot. Source: Skandinaviska Test for laget, AB, Oxen Stiersgaten 17, Stockholm NO, Sweden.

Roach and Kephart (1966). Purdue Perceptual Motor Survey. This survey has a total of 22 scorable items within the three major areas of laterality, directionality, and skills of perceptual motor matching.

Laterality: awareness within the body of right and left.

Perceptual motor matching: comparison of perceptual information with information already existing in the organism. Reception, contour, form, and spatial content measured.

Directionality: this subtest measures right-left, up-down, and before-behind process of perceptual projection outside the body.

Ontogeny and Appropriate Equipment for Laterality

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
1-3	Head predominately rotated to a preferred side. Lies in a tonus-neck-reflex attitude (Gesell).		
4-8	Tends to unilateral approach. Symmetrical postures predominate in supine position (Gesell).	Rubber balls, beanbags, rattles which encourage child to reach.	
8	Shows unilateral hand manipulation, other hand remaining passive (Gesell).		
13	Combination of lateral and overhand approach.	Any push toys which require two-handed steering, such as push carts, carriages, lawn mowers.	Must be sturdily balanced. No removeable parts which would come apart if used for support in gaining vertical position.
14	Overhand approach predominates.	Balls, beanbags, blocks of various sizes.	Beanbags constructed with minimal possibility of opening. Large enough stuffing to prevent swallowing, perhaps edible (eg. M&M's).

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
24	Manipulates unilaterally, but occasionally makes bilateral approach.		
42	Predominate right handed manipulation shifts to left hand (or vice versa), or to alternation.	Toys encouraging left to right progression such as bead stringing, sewing cards, abaci.	Strings without metal tips which might puncture skin. Materail of wide enough diameter to prevent cutting into skin. Material short enough to prevent entanglement.
48	Can make circles (in the air) with the index fingers of both hands for 10 seconds with the arms extended horizontally at the sides in a seated position (OT). Can clasp another's right hand, first with right hand then with the left hand, finally with both hands (OT).	Large muscle equipment that provides opportunity to use both sides of body in a combined effort, e.g., climbing equipment, equipment to crawl through tricycles, equipment on which to balance.	Sharp edges on which the child could fall. Equipment too far from ground could precipitate frustration and dangerous falls. Pieces too large to hold onto may be causing loss of grip. Too steep an incline leading to loss of balance. Steps too far apart allowing slippage through them. Tricycles must have wide base of support to prevent tipping over with shifts in weight.
60	Left to right orientation. Can cross left knee over right one, with directions (OT).	Seriation toys which require left to right progression, (eg. cubes arranged according to size).	

Conditions to Develop Laterality

Activity: Hokey Pokey

1. Learner Outcome: to develop laterality.

2. Conditions

   a. Learner Characteristics--First graders.

   b. Situational Variables--Group activity.

   c. Strategy--Directive

   Procedure:

   Sing "Hokey Pokey" song performing various appropriate activities.

d. Content: Hokey Pokey

3. Evaluation--This proved to be a good activity to help the children distinguish right from left.

Activity: Simple Simon Says

1. Learner Outcome: to develop laterality and directionality.

2. Conditions

a. Learner Characteristics--5 to 8 year olds.

b. Situational Variables: A group activity, with individual attention at certain times during the game.

c. Strategy--Teacher directed.

Procedure:

Children are lined up horizonta-ly and at arms distance with the teacher in the front, facing the children, (the usual Simple Simon format), Teacher explains the rules of the game to those that are unfamiliar with them. The leader (in this case the teacher) begins with easy gross motor skills (S.S. says put your hands on your waist, S.S. says jump up and down 4 times, etc.) and then proceeds to combination tasks (S.S. says hop to your left 2 times and then to your right 2 times.

d. Content--none.

Verticality

The perception of the upright (verticality) is a necessary development in children, as they continually depend on this posture as they relate their bodies and the environment. Through posture, the child maintains a constant orientation to the earth's surface and to the environment which surrounds him.

Good posture is important for proper functioning of the body and contributes to good appearance. Proper alignment of the body parts promotes efficiency of movement and endurance. The person with good posture who moves gracefully projects poise, confidence and dignity. From a mechanical standpoint, good posture allows bones and joints to be in position to take the stress of weight and movement and the musculature is firmly balanced in order to hold body organs in place. With poor posture, the bones are out of line and the muscles and ligaments bear undue strain, even pain. In some instances, poor posture affects the position and function of organs, specifically those in the abdominal regions. Habitually faulty posture means being in a position of poor alignment continuously, or most of the time. This results in an adaptive stretching or shortening of muscles.

To sit erect, but also at ease, the type and size of chair must be suited to the individual. Sitting in a slumped position puts a strain on many parts of the body, particularly the back. Sitting up too straight overarches the lower back. A common posture harmful to health is when the neck and head are sloped forward, and the shoulders rounded. The upper back thus curves out while the lower back curves in. This over-tilts the pelvis, and affects hip joints and leg movements.

A chair satisfies postural requirements when the child is able to sit against the backrest and the height of the seat is the same as the shod leg. When children sit on chairs that are too low, there is a tendency for them to slouch and develop poor postural habits. When chairs are too high, children are forced to "perch" on the front of the seat, thereby sacrificing the comfort of the backrest. The differences between short and tall children necessitates chairs and tables of more than one size. Otherwise, postural needs of most children are being ignored.

Posture also provides for safety. If a child cannot maintain the relationship of his/her center of gravity to the earth's surface, then he/she is not in a position to move or respond quickly and efficiently. The postural mechanism exerts dominance over our behavior, as exemplified when trying to "let" oneself fall. It becomes almost impossible to consciously lose balance and thereby fall on one's face.

One must not use adult posture as the criterion of normality for posture in children. Children a different ages have a posture which is typical of that age and which is normal for them. Posture has a series of developmental characteristics, includ-ind flat feet, bow legs, knock knees and a toed-in gait.

Flat Feet - When children begin walking, they do so upon feet that appear flat, partly because there is a true flatness of the medial longitudinal arch and partly because the arch is filled in by a fat pad which eventually disappears. Over the next four or five years, the majority of children develop a medial longitudinal arch, but there are approximately 15 percent who remain flat-footed throughout life. Those people who remain flat-footed seldom have trouble resulting from the planus shape of their feet.

Bow Legs - This is a postural characteristic at a certain age; common from the beginning stages of walking to the age of 2 1/2 years; and seldom requiring treatment.

Knock Knees - This is a situation in which there is a characteristic posture at a certain age, especially between the ages of 2 1/2 and 7 years.

Toed-In Gait - Toed-in gait in children may have one or more of three anatomical causes: (a) inset hips (hips which have internal rotation in excess of the range of external rotation; common between the ages of 4 to 12 years); (b) internal torsion of the tibias which is commonly present from the age of walking to 2 1/2 years; and, (c) metatarsus adductus, commonly present from birth to the age of 5 years. These three conditions are all typical postures at a certain age, and all have a very strong tendency to improve and correct themselves.

O'Donnell (1969) distinguishes between static posture (posture while remaining in one position) and dynamic posture (posture while moving), believing that more emphasis should be placed on the latter than on the former (as is traditionally done). He further notes that children should be taught ways of improving their dynamic posture, much in the way that skiers are taught. Nading the center of gravity closer to the base of support, enlarging the base of support, and using limbs and utensils to compensate for the shifting center of gravity are all ways to improve dynamic posture.

Measures for verticality. The following tests may be used to measure verticality:

Davies, E. The Elementary School Child and His Posture Patterns. New York: Appleton-Century-Crofts, Inc., 1958. A description of an informal means for evaluation static posture.

Schurr, E. L. Movement Experiences for Children's Curriculum and Method for Elementary School Physical Education. New York: Appleton-Century-Crofts, 1967. Criteria for evaluation static posture as presented.

Harris, A. J. Harris Tests of Lateral Dominance. Third addition, New York: The Psychological Corporation, 1958. Ratings are provided for hand, eye, and foot preference.

Also refer to Frankenburg and Dodd's Denver Developmental Screening Test discussed under "Measures for Fine Motor Abilities."

Ontogeny and Appropriate Equipment for Verticality

Age in Months		Appropriate Equipment	Potentially Hazardous Conditions
2	Holds head bobbingly erect (Gessell).	Infant carriers with gripping action when placed on smooth surface.	Without grips, infant may kick self off platform.
6	Sits unsupported for a few seconds (MT).	Solid padded bar upon which child can pull self and which does not give with weight.	Mobiles left in crib may be used for pulling.
7	Sits briefly leaning forward on hands (Watson & Lowrey). Supports large fraction of weight in standing (Watson & Lowrey). Bounces actively in supported standing (Watson & Lowrey).	Bouncers, equipment on which they can support themselves.	Exposed springs which might catch fingers and/or pieces of skin. Too wide support which would keep legs too far apart. Equipment with sharp corners, jagged edges, on which child could fall.
11	Sits steady indefinately (Watson & Lowrey).		Because infant sits only briefly, high chair needs seat belt to go around hips to prevent slipping through.
12	Stands alone temporarily without support (MT). Expresses sense of "up and down" by wriggling and gesture.	Large cubes or pieces of equipment on which they can support themselves and which they can use departing points.	
15	Increased tendency to tilt head back and to circumduct arms upward and backward. Walks few steps with self-starting and self-stopping (Gesell).		
18	Propensity for vertical orientation. Sits directly in a small chair (MT & Watson & Lowrey).	Small chairs which can be easily used for sitting and rising, of many heights and depths to provide for early and good posture.	Smooth rounded edges to prevent splinters, cuts, etc.

Gross Motor: Verticality (continued)

Age in Months	Stage	Appropriate Equipment	Potential Hazardous Conditions
24	Stands with heels together (CDP).		
48	Spread of general posture; less totality in bodily orientations.		
60	Posture is predominately symmetrical and closely knit. Frequently alternates posture from standing, sitting, and squatting.		
64	Likes to lie prone on floor while reading, doing puzzles, etc.		
68	Frequently assumes awkward positions.		

Conditions to Develop Verticality

Mat on floor activities: these activities help the child develop proper general posture.

Crawl on your tummy
Creep on your hands and knees
Lie on your back and stretch
Lie on your side, curl up like a ball, and then stretch your legs and arms

Basic fall: to help the child gain freedom of movement and to make him aware of how to protect himself if falling.

Get down on your hands and knees on the mat. Lift one hand from the mat and place it on your opposite chest. Hold your elbow against your tummy. Fall on your upper arm and leg. Remember to fall on the side that has your hand off the mat. Roll over onto your back. Keep rolling like a ball until you are off the mat. This time when you fall, roll completely over, coming up on your hands and knees.

Directionality

Directionality is the perceptual projection of directional concepts (i.e., left-right, up-down, and before-behing) into external space. Only through such projection can outside objects come to have spatial dimensions or relationships.

Gesell (1940) and Piaget (1963) discuss the developmental sequence of directionality in terms of "egocentric localization" where objects are seen in relation to self (subjective space) and "objective localization" where objects are seen in relation to each other (objective space).

An intermediate step in transferring laterality to directionality is supplied by the eye, and their kinesthetic feedback. Children must be able to control their eyes with accuracy and know where the eyes are pointed. A great deal of information about space and the location of objects in space comes to us through our eyes. In a similar manner, the child learns up and down by transferring the "up-down" in his/her body to the "up-down" into outside space.

Thus, observations of relationships between objects in space becomes difficult, if not impossible, until laterality and verticality are clearly established within the body. The development of directionality should be looked at in terms of the ontogenetic gradients provided earlier for laterality and verticality.

Conditions to Develop Directionality

Activity: Merry-Go-Round using a Parachute

1. Learner Outcome: to develop directionality by stressing right and left.

2. Conditions

   a. Learner Characteristics: 6-10-year-olds

   b. Situational Variables: gymnasium or playground
      an entire class on playground

   c. Strategy--Directive

      Procedure:

      1. Ask children to form a circle around the outside of the parachute.
      2. Practice inflating parachute (students raise parachute over heads), and deflating (parachutes at waist).
      3. Inflate chute, holding with right hand.
      4. Walk to the left eight steps.
      5. Deflate.
      6. Inflate holding with left hand and walk to the right eight steps.
      7. May be changed by skipping, hopping, or running instead of walking.

   d. Content: use of parachute.

Activity: Rope use

1. Learner Outcome: to develop directionality.

2. Conditions

   a. Learner Characteristics: 5-year-olds

   b. Situational Variables: individual or group activity

   c. Strategy: Directive

      Procedure:

      1. Have child make circle, square, triangle on floor with rope.

      2. Instruct child to stand on left side, right side, inside, walk around, stand in front of and behind rope.

   d. Content--rope

Activity: Moving with Eyes Closed and Led by Another Child

1. Learner Outcome: to develop directionality

2. Conditions

   a. Learner Characteristics--3 to 6-year-olds; leader must have vision and both children must be able to walk.

   b. Situational Variables--in classroom; group activity (children work in pairs).

   c. Strategy--Developmental

      Procedure:

      Children work in pairs, with one child leading the other child, whose eyes are closed or who is blindfolded

      Suggest that the leading child move in many different ways. "How many different ways can you move and lead your partner?"

      The leader may not talk to his partner, but must indicate changes in level or direction by the use of hand pressure.

   d. Content--blindfolds (optional)

   e. Resource--none

PHYSICAL ABILITIES

Many physiological and anatomical factors limit an individual's ability to perform perceptual-motor tasks. For example, a child's ability to pedal a bicycle depends on many factors, including the utilization of force (the contractile strength of various muscles), maintenance of sufficient speed (governed by the mass of the limbs and the strength), the ability to balan-e the bicycle (a function of the vestibular mechanisms of the inner ear), and the interaction of all perceptual systems.

A child's individual motor performance is therefore based in part on the ability to cultivate and deal with the following individual physical abilities:

strength - the capacity to exert muscular force.
flexibility - the range of motion at a particular joint or combination of joints.
balance - the ability to maintain the body in equilibrium relative to gravity.
agility - the ability to move the body or its parts through space while changing directions quickly and accurately.
endurance - the ability of the body to work against a moderate resistance over a period of time.

Each of these physical abilities is important in the performance of gross motor skills, and will be discussed in the following section in terms of its developmental sequence.

In addition to these fundamental physical abilities, several other characteristics such as speed, power, coordination and syncrony are found in the more mature perceptual-motor skills. For example, the concept of speed (the ability to perform rapidly successive movements over a short period of time), may be conceived of as a combination of such physical abilities as strength, flexibility and balance. The concept of speed contains within it the notion that a child must respond to specific environmental stimuli (reaction time) and execute a prescribed movement sequence as rapidly as possible (movement time). Speed is therefore a component of many of the child's movement skills, and is implicit in such movements as running, swimming, and throwing. The importance of speed becomes apparent in the mature motor patterns which are discussed later.

Similarly, the production of power is critical to many forms of motor performance. In general, power refers to the ability to produce an explosive movement in the shortest period of time, and is reflected in such activities as the high jump, broad jump, and 100-yard dash. A powerful child must use the physical abilities of strength plus speed.

Perhaps the key to efficient motor behavior is the child's ability to coordinate the individual physical capacities in a meaningful way. The concept of coordination emphasizes the need for rhythmic, synchronous movement of the entire body. It is reflected in the smooth, balanced, flowing qualities of the movements of the professional athlete, and in the principles of opposition (i.e., hand and foot opposition in walking), rotation, and sequential joint action of many of the perceptual-motor skills of the maturing child. The concepts of opposition and symmetry are critical because of the implicit use of both sides of the body. That is to say, each movement pattern of the child follows a sequence of development from the relatively undifferentiated "raw" skill to the highly organized efficient movement which demonstrates a high level of coordination.

The physical abilities discussed in the following section include the developmental sequences involved in the attainment of strength, flexibility, balance, agility and endurance. The normative data are reported in terms of scores for both boys and girls because in general, until age four, boys and girls move very much alike, with girls (especially before age three) having (Sinclair, 1973). After age four, boys appear to be somewhat advanced in tasks requiring strength and especially in the skills of throwing. On the other hand, boys and girls are able to execute uneven locomotor patterns (skip, gallop and slide) at approximately the same age, but girls attain proficiency more rapidly. Prior to age ten, such differences are quite likely the result of traditional social influences and expectations while during adolescence the differences may be due to the gains in weight, size and strength for males.

Learner Characteristics: Physical Abilities

Terminology	Characteristics	Areas of Development Affected by LC	Conditions for Atypical Characteristics
achondroplasia (ah-ken-dro-pla'ze-ah)	A disease of the skeleton beginning in fetal life and producing a form of dwarfism.	General motor development may be somewhat retarded due to the reduced muscle-bone ratio and relatively smaller appendages (i.e. slow running speed, reduced strength)	Provide a well rounded program of gross motor skills, recognizing the limitations imposed by the trunk/appendage ratio & designed to facilitate the development of strength and flexibility
anyotonia congenita (ah-mi-o-to'ne-ah) (Oppenheim's Disease)	A rare congenital disease of children marked by general hypotonia of the muscles.	Reduced muscular tonus with concommitant reduction in strength and flexibility.	General activity to facilitate development of strength or to augment general motion for circulatory and respiratory funccions.
apraxia	A brain disorder characterized by loss of ability to manipulate and use common objects and to execute planned movements.	General disruption in purposive activities & motor skills which require a longer duration of goal orientation or sequenced activities.	Movement activities to foster fine motor skills and manipulative tasks as well as progressively longer and more complex perceptual motor skills.
asthma	Susceptibility to various allergies, contributed to by emotional stress, excess exertion or temperature. Infection or endocrine factors. Characterized by coughing & heart and respiratory rate increased with shortness of breath.	Primarily affects skills which require continued expenditure of energy (i.e.endurance)	General program of physical education with controlled exercises of reduced duration.
ataxia (ah-tak'se-ah) (see Freidrich's disease)	A type of muscular incoordination characterized by lack of balance.	Activities which require balance, including agility and locomotor skills.	Experiences dealing with the various factors of balance should be controlled and carefully structured.

Learner Characteristics: Physical Abilities

Terminology	Characteristics	Areas of Development Affected by LC	Conditions for Atypical Characteristics
athetosis (ath-e-to'sis)	Involuntary movements of the head, body, extremities or tongue. A sub-classification of cerebral palsy.	Walking is characterized by lurching and nonrhythmic patterns. Voluntary purposive activities do not seem to follow any sequence.	Special attention should be placed on relaxation and coordination. Increased tension causes exaggerated symptoms.
brachial birth palsy (bra'ke-al) (Erb's palsy)	Paralysis or partial paralysis of the arm resulting from injury to the nerves at birth. It may affect the forearm, upper arm, or whole arm.	Manipulative activities involving the affected appendages.	Structured activities designed to utilize the affected limb or to use the contractual limb in an attempt to utilize the cross-lateral neuromuscular facilitation.
Calve-Perthes disease (Legg-Perthes)	A disease characterized by softening and crumbling of the head of the femur that fits into hip socket.	Affects locomotion and balance primarily, and may also result in lessened force production by the affected appendage.	Requires rest from weight bearing and strain; followed by careful rehabilitation.
cerebral palsy (see also athetosis)	Weakness or paralysis due to brain lesion. The term is applied to a group of diseases in children marked by paralysis or by disturbances of motion.	Paralysis of limbs may affect locomotor or purposive activities as well as balance.	Development of relaxation should be emphasized. Physical therapy for affected areas and general physical activities.
club foot	A bony deformity of the foot either congenital or acquired early in life. (Condition is generally correctable early in life).	May affect locomotor skills and purposive activities involving the lower extremities.	Generally correctable by surgery or careful regimen of remedial exercises for the affected limbs, especially for strength & flexibility.

Learner Characteristics: Physical Abilities

Terminology	Characteristics	Areas of Development Affected by LC	Conditions for Atypical Characteristics
cretinism (kre'tin'izm)	A condition due to congenital lack of thyroid secretion. It is characterized by arrested physical and mental development with large head circumference; dwarf body; waddling and shuffling gait; heavy skull; thick bones; abundant black wiry hair; eyes in horizontal position; broad, flat nose; large ears; dry, pale, wrinkled skin; short, broad neck; round, protruding abdomen; short, brittle fingernails, a condition due to thyroid pathology.	Primary problems with force production and balance due to imbalance of muscle/bone ratio	General regimen of physical education activities, to include a well-balanced series of activities.
cystic fibrosis	Dysfunction of exocrine glands with impaired digestion and absorption, chronic pulmonary disease and respiratory tract allergies with excessive sweating & heat prostration.	General motor development may be anticipated at a reduced level due to limited general experience; specific, localized movement characteristics are not generally associated with this disease.	Moderate physical activity to promote general tonus and circulation, coupled with physical therapy to promote bronchial drainage. Avoid overexhaustion or exercise which causes excessive thermoregulation.
diabetes meelitus	Hereditary metabolic disease affecting the ability to oxidize carbohydrates due to reduced insulin production.	No specific area of effect, except as activity may be limited to reduce possibility of injury and susceptibility to infection.	Encourage sound program of regular exercise to establish a uniform metabolic base.

Learner Characteristics: Physical Abilities

Terminology	Characteristics	Areas of Development Affected by LC	Conditions for Atypical Characteristics
diplegia (di-ple'je-ah)	Paralysis affecting like parts on both sides of the body; bilateral paralysis legs more often affected than arms.	Purposive and locomotor activities which require bilateral or contialateral movements for the production of force or maintenance of balance.	Optimal exercise program based on severity of problem. May include passive movements of affected limbs.
dyschondroplasia (dis'kon-dro-pla'ze-ah)	A condition of abnormal growth of cartilage with resultant deformity of the bony skeleton.	Reduced flexibility and strength at the affected area.	
epilepsy (ep'e-lep-se)	A chronic condition characterized by seizures of varying duration in which there is a loss of consciousness with or without a succession of convulsions.	A major problem confronting epileptics is that of losing consciousness. May be somewhat dangerous to work in a non-supported environment (i.e. on gymnastic equipment). In general, however, epileptic seizures seem to occur less while participating in physical activity.	A well-rounded program of motor activities with carefully supervised activities especially in such areas as swimming and gymnastics.
epilepsy (petit mal)	Condition seen more in childhood with periodic loss of consciousness, sometimes with falling and without convulsive movements. Duration is 3 to 11 seconds.		
epilepsy (grand mal)	A seizure in which there are severe convulsions and loss of consciousness, or coma, usually with cry, falling, arching of back, and tonic and clonic movements of arms and legs. Breathing is interrupted and there is confusion or drowsiness afterward.		

Learner Characteristics: Physical Abilities

Terminology	Characteristics	Areas of Development Affected by LC	Conditions for Atypical Characteristics
epilepsy (Jacksonian)	Epilepsy mainly limited to one side and often to one group of muscles. The seizure is often confined to one leg or to one part of the body without loss of consciousness.		
epilepsy (phychomotor)	An epileptic equivalent in which the patient performs motor acts which he cannot remember having done (i.e. rubbing the eyes, hallucinations, temper outbursts)		
fragilitas ossium (frah-jil'e-tas os'sium)	A disease in which the bones are abnormally brittle and therefore, subject to fractures following slight injury.	Primarily affected by the necessity to restrict activities and general experiences to avoid injury to skeletal system.	Avoid activities which may result in skeletal injuries. However, attempt to provide well-balanced sequences of activities to foster total motor development.
Friedrich's disease (ataxia)	An inherited disease usually beginning in childhood or youth. It is characterized by ataxia, speech impairment, curvature of the spine, paralysis of muscles especially of the lower extremities.	Activities requiring neuromuscular coordination and strength.	Activities designed to facilitate and contralateral and ipsilateral movements and general therapeutic activities for the affected limbs.
hemophilia (he-mo-fil'e'ah)	A hereditary blood disease characterized by delayed clotting and consequent difficulty in checking hemorrhage. It is inherited through the mother by males.	General motor ability should be expected except where early experiences have been withheld to avoid injury.	Prevention of injury and control of hemorrage. May require orthopedic care to prevent permanent deformity of joints.

Learner Characteristics: Physical Abilities

Terminology	Characteristics	Areas of Development Affected by LC	Conditions for Atypical Characteristics
hydrocephalus (hi-dro-sef'ah-lus)	A condition characterized by abnormal increase in the amount of cerobrospinal fluid and accompanied by enlarged cranium and dilation of the cerebral ventricles. The disease causes enlargement of the head and prominence of forehead; it may produce atrophy of the brain mental retardation and convulsions. The degree of mental retardation depends upon degree of cortical destruction, not size of skull.	General motor ability should be expected where early experiences were "normal".	A well rounded program of motor development would be advised except where susceptibility to cortical injury would contraindicate.
hypertonia (hi-per-to'ne-ah)	Excessive tone, tension of activity of the musculature.	General motor coordination may be impaired by the imbalance of contracting and relaxing muscles.	Activities for facilitating relaxation and flexibility.
hypertrophy (hi-per'tro-fe)	The enlargement or overgrowth of an organ or part (i.e. muscle bulk)	Generally accompanies increase in strength. If condition is not desirable, reduced stress should be applied and part should be rested.	Caused by increased stress on a muscle group.
infectious hepatitus	Virus spread through direct contact or contaminated food or water. Characterized by fever, loss of appetite, nausea, headache, jaundice.	General loss of vitality (strength, endurance, etc.)	Requires initial bed rest and then later controlled level of moderate exercise until recovery.
kyphosis (ki-fo'sis)	Humpback, abnormal curvature and dorsal prominence of the vertebral column.	Muscle strength is generally greater on anterior (front) side and flexibility on back.	Activities emphasizing back strength (shoulder girdle area) and relaxation (flexibility) on anterior.

Learner Characteristics: Physical Abilities

Terminology	Characteristics	Areas of Development Affected by LC	Conditions for Atypical Characteristics
Legg-Perthe's disease	Probable circulatory disturbance caused by injury or strain. May cause flattened femur destruction of bone tissue and muscular spasm in lower extremities.	May affect locomotor patterns purposive activities of the affected limb and posture.	Requires rest from weight bearing and strain until pain and muscular spasm subside.
Mentally Retarded and Slow learners	A condition of sub-average intellectual functioning which originates during the developmental period and is associated with impairment in adaptive behavior.	Motor characteristics for the educable mentally retarded and slow learners are probably more like those of average children than any other trait. It is safe to conclude from research, however, that these children are significantly less capable in motor development and skills than children with average intelligence. There is a positive relationship between low intelligence and poor motor proficiency. Educable mentally retarded children perform well behind other children in gross motor profficiency and on measures of physical fitness, but they are even further behind in fine-motor skills (Stein, 1963; Meyer, 1972) (Harring, p. 324)	Mildly retarded respond well to structured training programs in physical education (Soloman and Pangle, 1967) (Dunn,)

Learner Characteristics: Physical Abilities

Terminology	Characteristics	Areas of Development Affected by LC	Conditions for Atypical Characteristics
Totally dependent (I.Q. 0-24)	Generally incapable of being trained for economic usefulness, social participation or total self care. Generally require complete supervision and care throughout life because they cannot adequately care for personal needs, protection or communication.	There is a low positive correlation between intelligence and motor skills among the mildly retarded, but in general can perform a wide variety of motor activities.	Self care skill should be emphasized and basic spatial-motor activities utilized for the development of basic levels of fitness and perceptual experience.
Trainable (I.Q. 25-49)	Generally learn to speak understandably, perform simple routine tasks under close supervision and develop self-care skills.		
Educable (I.Q. 50-74)	General intellectual functioning which is below the average of the general population but with potential for minimal academic skills and in general will maintain an independent life in the adult community.	In general, because mentally retarded individuals are limited in their intellectual sphere, it is especially important to provide a wide variety of motor activities which may be utilized for recreational experiences. In addition to providing leisure activities, the physical skills should contribute to basic levels of physical well-being as well as to the social and psychological aspects of life.	
lordosis (lor-do'sis)	Curvature of the spinal column with a forward convexity of lumbar spine.	Activities requiring abdominal strength may be difficult because of restriction placed by the abnormally tight lumbar muscles of the back.	Avoid activity which requires or have propensity toward hyperextension of lumbar spine. Emphasize activities requiring abdominal strength to provide compensation.
Mongoloid	Characterized by eyes obliquely placed; fold of skin at inner edge of eye; flat, round face; round cheeks; large flat lips; large long tongue usually protruding from mouth; small nose. Generally accompanied by mental retardation.	Motor activity may be characterized by gross, non-specific reactions and general lack of efficient movement.	A well rounded series of activities designed to foster total perceptual-motor integration and facilitate general levels of fitness.

Learner Characteristics: Physical Abilities

Terminology	Characteristics	Areas of Development Affected by LC	Conditions for Atypical Characteristics
monoplegia (mon-o-ple'je-ah)	Paralysis of a single limb.	Motor activities requiring use of the affected limb or the use of that limb for counterbalance i.e. slipping without opposition)	Concentrate on compensatory techniques in movements and on physical therapy to rehabilitate the affected limb.
multiple sclerosis	A progressive disease of the central nervous system causing in young adults, weakness, uncoordination, spasticity, involuntary movements of the eyes and extremities and an unsteady gait.	General motor coordination will be affected.	Exercises for neuromuscular reeducation. General conditioning activities to maintain a high level of physical fitness or organic vigor
muscular dystrophy	Deterioration, degeneration and wasting away of muscle tissue.	Muscular strength and basic coordination necessary for purposive and locomotor skills.	Recreational games and physical therapy to maintain functional motion and prevent deformities (generally will not restore or arrest the process).
myotonia (mi-o-to'ne-ah)	Increased muscle tone due to disease of the nervous system.	Lack of flexibility and consequent tendency toward muscle and ligament injury.	Medical treatment to reduce muscle tonus and regimen of physical therapy to maximize range of motion and relaxation.
myxedema	A disorder characterized by lethargy and dullness resulting from a lack of thyroid secretion.	Reduced level of general activity especially in relation to strength and endurance.	General regimen of moderate activity.
Osgood-Schlatter disease	A condition marked by pain and swelling of the tibia just below the knee cap.	Production of force by extension of lower leg may be limited.	Reduce tension and strain on affected limb; therapeutic exercise usually contrainducted.

Learner Characteristics: Physical Abilities

Terminology	Characteristics	Areas of Development Affected by LC	Conditions for Atypical Characteristics
osteitis (os-te-i'tis)	Inflammation of a bone; the disease is marked by enlargement of the bone tenderness and a dull aching pain.	Production of force and motion in the affected limb may be limited.	Physical activity may be initially contraindicated with ultimate physical therapy required to restore strength and flexibility.
osteochondritis (os'te-o'kon-dri'tis)	Inflammation of both bone and cartilage. (Generally affecting the epiphysical centers).	Locomotor and purposive skills with the affected limb. Disease often manifested by pain and accompanying limp, general weakness and intiability.	Avoid excessive strain to the affected limb. Moderate exercise recommended to increase circulation and maintain range of motion. Must be treated with antibiotics and child should be protected from injury.
osteomyelitis (os'te-o-mi-e-li-tis)	Inflammation of bone caused by pus forming organisms. It may remain localized or may spread through the bone to involve the marrow, cortex, and periosteum. Destruction of bone may result and requires surgical treatment.	Generally involves removal of affected bone with consequent limitation of activity.	Vigorous physical activity may be contraindicated. Moderate series of activities for total perceptual-motor involvement.
palsy (pawl'ze)	A synonym for paralysis, used in connection with certain special forms to denote incomplete paralysis.	Locomotor and purposive activities requiring the involved body parts may be limited as well as basic strength and flexibility.	Physical therapy for the affected areas, emphasizing a balance of strength and flexibility.
paraplegia (par-ah-ple'je-ah)	Paralysis of the legs and lower part of the body, both motion and sensation being affected.	Major areas of polio involvement may be affected.	General program to rehabilitate affected areas and to increase strength, flexibility and endurance.

Learner Characteristics: Physical Abilities

Terminology	Characteristics	Areas of Development Affected by LC	Conditions for Atypical Characteristics
poliomyelitis (pol'e-o-mi-e-li-tis)	Inflammation of the grey matter of the spinal cord; infantile paralysis resulting in pain, spasticity, weakened and paralyzed muscles and skeletal deformities.	Locomotor and purposive activities requiring the use of the involved limb	Physical exercise program to maintain mobility and increase endurance, strength and flexibility.
progressive muscular atrophy	Progressive wasting of muscles with paralysis due to degeneration of the spinal cord.	Activities requiring production of force or maintenance of a certain level of muscle tonus (i.e. balance, locomotor, etc.)	Passive resistance exercises designed to produce movement in the affected appendage.
rheumatoid arthritis (juvenile)	Inflammation of joints and tendons. Generally involves severe pain in joints and may involve localized pressure on digital or peripheral nerves; tends to be familial.	Limits range of motion and production of force; severe weakness and fatigue.	Requires rest with supervised activity and massage.
rheumatic fever	Chronic infection of connective tissue, affecting joints, heart, and blood vessels. Heart damage may occur from prolonged attacks.	Limits strength and especially endurance.	Rest and limitation of activity during acute stage.
rickets (rik'ets)	A deficiency disease of infancy and childhood due to lack of vitamin D. The normal process of ossification is disturbed causing bending, distortion and nodular enlargements of the bones.	Locomotor activities are primarily affected, with some purposive activities requiring modification.	Generally requires nutritional supplement and therapeutic exercise to strengthen affected limbs.
rigidity (re-jid'i-te)	Stiffness or inflexibility	Flexibility is primarily affected with resultant decrease in locomotor and purposive skills.	Activities designed to emphasize flexibility of motion and relaxati

Learner Characteristics: Physical Abilities

Terminology	Characteristics	Areas of Development Affected by LC	Conditions for Atypical Characteristics
Scissors Gait	Gait characterized by crossing of the legs due usually to spasm of the adductor muscles of the thigh (inside leg)	Locomotor skills limited.	Emphasize activities to strengthen lateral (abductor) muscles and relax adductor muscles (swimming is often strongly recommended).
scoliosis (sko-le-o'sis)	Lateral curvature of the spine.	Limits range of motion, flexibility and often strength of the back muscles.	Often requires artificial means for connection (i.e. bracing) and an exercise program to provide compensatory strength.
spastic hemiplegia	A condition in which one hemisphere or side of the body is affected with spasticity.	Locomotor and purposive activities may be limited or materially altered.	Physical therapy to augment activity in the affected appendages and to facilitate flexibility and strength as well as relaxation.
spasticity (spas-tis-i-te)	Marked hypertonus of muscles.	General lack of flexibility and limited range of motion in conducting purposive and locomotor activities.	Activities emphasizing range of motion and relaxation.
spina bifida (spi'nah bif'ida)	A congenital malformation consisting a defect in the vertebrae incomplete closure of lamina) through which the contents of the spinal canal may protrude.	Limitation of activity required to protect exposed neural tissues.	Sedentary games of perceptual-motor nature or modified activities for strength. (The majority of gross-motor activities may be contraindicated.)
talipes (tal'i-pez)	Clubfoot: a deformity of the foot in which it is twisted out of position.	Locomotor skills are primarily affected, and demonstrate atypical characteristics, specifically attributable to the anatomical deformity.	

Learner Characteristics: Physical Abilities

Terminology	Characteristics	Areas of Development Affected by LC	Conditions for Atypical Characteristics
talipes equinus (e-qui'nus)	Foot deformity in which the person walks on toes or forefoot, often due to contracted heel cord.	Locomotor skills are primarily affected, and demonstrate atypical characteristics, specifically attributable to the anatomical deformity.	Exercises to strengthen muscles on top of foot and relax muscles on back of lower leg.
talipes valgus (val'gus)	A clubfoot on which the patient walks on the inner border of the foot, the sole being turned outward.		Exercises to relax muscles on lateral border and strengthen medial muscles.
talipes varus (va'rus)	A clubfoot on which the patient walks on the outer border of the foot, the sole being turned inward.		Exercises to relax medial muscles and strengthen lateral muscles.
visually impaired		Running and general motor ability is generally poorer than that of sighted children (Cratty, 1971). No clear information that coordination and strength are necessarily deficient.	Children may progress in early motor development at normal rate when assistance is provided to insure a full range of early experiences.

Strength

Strength may be defined as the amount of force that can be exerted by a single muscle or a group of muscles in one single maximum effort. Strength is influenced by the size of the muscle, is specific to the muscle or muscle group, and can only be increased if the muscle is required to perform a greater amount of work than usual. Strength can apply to specific muscle groups, as in gripping, or to the whole body as in running or lifting weight. It is also a critical component in pushing, carrying, kicking, throwing, climbing, and jumping as well as in such exercises as sit-ups and push-ups.

Strength is fundamental to movement for it is the capacity to exert variable and appropriate amounts of force to resolve a performance demand. The child must have an adequate degree of muscular strength to move the bony levers of the skeleton in the desired directions. Several different forms of strength have been identified. Static strength may be thought of as the ability to exert force (pounds of pressure) against an immovable object. Dynamic strength or power is force applied through a range of motion in a controlled manner. Ballistic, or explosive strength, is the ability to propel a relatively heavy object.

The infant utilizes force or strength to learn which objects are movable. The earliest manifestations of strength are when the infant moves in random and diffuse ways. The first definable pattern of muscular strength and alignment is probably the tonic-neck-reflex. This reflex is observed as the head and neck are turned, and the rest of the body moves in a precise and repeatable manner. The head must eventually move independently if the eyes are to serve the purpose of guidance through space. As the neck muscles strengthen and the child can gradually sustain the head in elevation for a period of time, the head and neck will resist the tonic-neck-reflex inclination and hold to a centering task.

Strength is perhaps the most fundamental of the physical abilities, for within the first year of life, the infant rises to a standing position and has thus overcome the limitation of gravity. Muscles hold the child's frame erect, and by stretching and contracting enable the child to move that frame in the desired direction at the appropriate speed. Muscular strength continues to develop throughout childhood, with almost no differences between boys and girls of the same body size and build until pubescence (Corbin, 1973).

Measures for strength

The following test may be used to assess strength:

Dell, E.A. Oseretsky Tests. American Guidance Service, Inc., Circle Pines, Minnesota, 55014. This test provides quantitative measurement of each child's motor development. In addition it provides data on posture, coordination, strength, rhythmic abilities, speed and accuracy. Ages 4-16.

Also see Orpet & Heustis' Movement Skills Survey discussed under "Measures for flexibility".

Ontogeny and Appropriate Equipment for Strength

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
0.1	Lateral head movement (Bayley).		Neck muscles are still not adequate to support the head at all positions. External support to the back of the head is necessary when lifting or holding young children.
0.7	Prone, lifts head (Denver)	Cribs	
0.3-3	Head held erect without support (Bayley).	Blankets	
0.7-4	Head held erect and steady (Bayley).	Car beds	
1.9-2.6	Prone, head up 45° (Denver).		
1.3-3.2	Prone, head up 90° (Denver), (4-6 in W&L).		
1-5	Holds head steady (Bayley). Sits with support (Bayley).		
1-6	Lifts leg into vertical position and grasps foot (LDS).		
1-6	When held with feet flat on floor, leaves weight on feet and bounces up and down (LDS). Kicks strongly with legs alternating (LDS). Moves arms briskly and holds them up to be lifted (LDS).		
2-4.3	Elevates self by arms (Denver).		
2-7	Rolls over to side from back position (Bayley) (Denver).		Children should not be left unattended on flat, elevated surfaces.
2-6	Sits with slight support (Bayley) (LDS).		

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
3.0-8.0	Pulls to sit (Denver) (Bayley).	High chairs Baby seats	Folding and/or moveable parts should be protected so that crushing and pinching hazards are reduced.
3-8	Tries to sit (Bayley).		Stable base of support required because children are quite active and may tip over
4-6	Head rotates with increasing freedom in supine position (LDS).		
4-6.5	Resists toy pull (Denver).		
4-8	Sits alone momentarily (Bayley).	Automobile baby seats	Some restraint should be provided to secure the child in the seat and to prevent sliding out of the seat because of inadequate postural strength
4.8-7.8	Sits without support (Denver).	Baby seats; jolly jumpers; bouncers; walkers	Strength may not be sufficient to control the head and maintain balance
5-10	Stands while holding on (Denver).		
5-12	Pulls self upright to a standing position (Bayley) (Denver) (W&L).		
6-11	Raises self to sitting (Bayley).		
7-14	Sits down with support (Bayley).		
9.1-13	Pulls to stand; Stands momentarily (Denver).		
10	Increased facility in head and trunk movements - tips head way back in ocular pursuit (W&L).		

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
9.8-18	Stands alone well (Denver) (Bayley).		
10.4-14.3	Stoops and recovers (Denver).		
15	Rises from sitting to standing position in middle of floor without furniture or wall support	Rocking Horse Rocking Chair	
15-30	Walks sufficiently well and can push or pull toys and objects	Pull toys, wagons, balls of various sizes	Beware of sharp edges and hard surfaces, moveable parts or breakable pieces
18-24	Squats to rest or play with object on ground and rises to feet without hands (LDS).		
21	Pulls and leads person to point out object of interest		
30	Can hang and support own body weight for four seconds (Sinclair).	Climbing tower, monkey bars	Put in sand, over carpet, or on soft surface to help protect from falls.
36	Rides tricycle, using pedals (W&L).	Tricycle	Appropriate size (pedal distance seat and handle bar height are important)
42	Rises to standing position from lying on back; body turns slightly during effort; no hand support (Corbin).		
60	Rises directly to standing position from lying on back without turning of body or hand support (Corbin).	Rug Mat	
72	Right hand grip strength 19-24 lbs. (Keogh). Can do 13 bench push ups (Kirchner). Pushes and pulls large blocks and to make houses, etc.	Chinning bar Climbing apparatus, bars Bench Wooden blocks Furniture Cartons Hollow barrels	Place in soft ground, sand, on mats, etc. Be sure the base of support provided by object is adequate and that they will not fold or collapse if climbed on or built upon

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
72	Carries objects of increasing weight Lifts with legs and controls weight while moving (Sinclair). 24 mo. - 8 lb. 36 mo. - 10 lb. 48 mo. - 12 lb. 60 mo. - 16 lb. 72 mo. - 20 lb.	Children should have access to objects of a variety of sizes, shapes, and weights, i.e. suitcases, boxes, pieces of wood, stools	At early ages avoid hinges or clasps which may pinch or crush Check for protruding objects (nails, screws, tacks, staples, etc.)
84	14 Bench push-ups (Kirchner). 12.5 Curl-ups (Kirchner). 20 squat jumps (Kirchner). Right hand grip strength 23-26 pounds (Keogh).	Climbing bar Horizontal ladder Fireman's pole Trapeze	Place objects over soft surface in case of falls
96	15 Bench push-ups (Kirchner). 15 Curl-ups (Kirchner). 22 Squat jumps (Kirchner). Right hand grip strength 28-31 pounds. (Keogh).		Inappropriately large weights or excessive exercise requirements may result in injury
108	Right hand grip strength 30-37 pounds (Keogh).		

Conditions to Develop Strength

Activity: Hi Water - Lo Water

1. Learner Outcome - To develop muscular strength

2. Conditions
   a. Learner Characteristics - preschoolers in good physical health
   b. Situational Variables - group activity
   c. Strategy - Directive

Procedure:

The two loose ends of a jump rope are attached to two poles with movable notches. The first time around, the rope is placed flat on the ground and the children line up in a single line behind it. Each child gets a turn to broad jump over the rope without touching it. After each child gets a turn, the rope is raised by one inch intervals. Each time the rope is raised, the activity increases in difficulty. If a child touches the rope while he jumps, he is out of the game. Towards the end of the game, when the rope is very high and it is impossible for the children to jump over it, they can run under it, without touching it. The game can be played over and over again.

d. Content - poles, rope

Activity: Tug of War

1. Learner Outcome - To develop an awareness of the location and use of shoulder muscles for pulling.

2. Conditions
   a. Learner Characteristics - ages 2 to 6
   b. Situational Variables - outdoor activity for a group
   c. Strategy - Directive

   Procedure:

   Ask the child to pretend to pull something heavy. Next ask several children to show how they would use their hands in pulling with a rope. The teacher stands holding one end of the rope and the children grasp the rope at the opposite end and they try to pull the teacher over a midpoint. If the children can pull the teacher over the midpoint, she will take one of them to her side to equalize the pulling power. When the sides are equal, the teacher will call attention to the muscles being used. Shorter lengths of rope may be given to pairs of children who want to play with each other.

   d. Content - one long rope, several short ropes.

Activity: Chinning Bar

1. Learner Outcome - To strengthen large muscles by pulling body up on a chinning bar.

2. Conditions
   a. Learner Characteristics - 5 and 6 year old children
   b. Situational Variables - classroom activity for interested individuals as interest center
   c. Strategy - Developmental

   Procedure:

   Parallel bar is placed in doorway entering classroom; a mat is directly under bar. Bar is placed so that every child can perform a desired activity. Children are free to experiment and explore individually or in pairs.

   d. Content - parallel bar, tumbling mat.

Flexibility

Flexibility may be defined as the range of motion present at a given joint. It also refers to the ability to move the parts of the body, relative to each other, with a maximum range of extension and flexion. Various aspects of flexibility are implicit in such things as bending (contracting and flexing one or more body parts) and stretching (extending and expanding one or more body parts) and may be observed in a child's play as reaching, twisting, turning, leaning, squatting, weaving between the bars of the jungle gym, turning on the parallel bars, skinning the cat (turning over while suspended from the rings or bars), etc.

Flexibility is specific to certain body regions. It should be noted that flexibility tends to diminish with age, but that this diminution is not necessarily the result of a limitation imposed by increasing strength. The only physical ability which diminishes with age during the growing years is flexibility (Frostig, 1969). According to Barsch (1968), flexibility tests of young children have been neglected in practically all studies of the psycho-motor dimension and the present review of literature generally verifies this lack of information about childhood flexibility.

Flexibility may be increased through moderate progressive stretching, which must be systematically undertaken because flexibility is specific to each joint in the body. Attempts to increase flexibility should emphasize the maximum extension of movement in the joints and stretching the muscles. Flexibility is an important factor in efficient movement and in the safety with which one may engage in a variety of sporting and play activities.

Measures for flexibility

The following instrument is useful in assessing flexibility:

Movement Skills Survey, Orpet, R.E., and Heustis, T.L. This check list was developed to assist classroom teachers, movement education supervisors, school psychologists, and other professional school personnel in evaluating selected aspects of a child's motor development. It is intended for use with Frostig-Maslo: MOVE-GROW-LEARN program and with MOVEMENT EDUCATION: Theory and Practice.

Conditions to Develop Flexibility

Activity: Caterpillar to Cocoon to Butterfly

1. Learner Outcome - To enhance flexibility through twisting and turning activities.

2. Conditions
   a. Learner Characteristics - ages 7 to 9
   b. Situational Variables - group activity outside
   c. Strategy - Developmental

Procedure:

Children in their own spots, within auditory range of story-teller, who says:

> 25 different sized and colored caterpillars are squirming, wiggling, creeping on the ground finding bits of grasses to nibble - growing fatter and fatter as they eat.

Cool air comes and season changes and caterpillars find a chosen spot to spand the winter. They begin to spin a cocoon, a home, around themselves in a small special space. They work and work to make this home and finally become very still, and quiet. There they stay until ...

The air is not so cold. The caterpillar feels strange inside his home. He wiggles and squirms quickly - and stops. He twists and twists slowly and quickly sometimes. The air is very warm.

He has been in his home long enough. He needs to stretch and move. With much twisting and turning he breaks open his shell and very slowly begins to stretch and unfold his new beautiful ... wings. What a lovely new creature. His legs are longer - 6 of them - and 2 antennae are on his head. His wings must dry and move in the sun as he gets used to his new self!

Another new discovery. If he moves these new wings in just the right way he can lift off of the tree branch and fly lightly - fluttering and stopping to rest and fluttering again.

He flits and tiptoes from plant to plant and place to place eating at one flower and resting here and there, sometimes playing with his friends in a meadow, without bumping into things. He will not live a long, long time so he enjoys every minute he can. He finds a spot of his own to sleep at night with his wings together.

d. Content - none

Activity: Rag Dolls

1. Learner Outcomes - To develop flexibility of the whole body, particularly the large muscles of the back, arms and legs.

2. Conditions
   a. Learner Characteristics - kindergarten through second graders.
   b. Situational Variables - group activity in classroom
   c. Strategy - Developmental

Procedure:

Play slow music on the record player and begin moving a rag doll in rhythm to the music. Giving as little overt direction as possible, suggest that the girls imitate the doll's movements, encouraging individual creativity and interpretation. The doll becomes fluid and limp, then erect and stretched out, then raising one arm and letting it fall, and then the other arm, then shaking all over, etc., with as many variations as time and imagination allow.

d. Content - a record player, recording of slow music, a rag doll.

Activity: Alphabet movement

1. Learner Outcome - To develop flexibility of movement by moving bodies into letter shapes.

2. Conditions
   a. Learner Characteristics - 5 to 7 year olds who are familiar with letters of the alphabet
   b. Situational Variables - in the classroom with the entire group, with a carpeted area large enough for creative movement

c. Strategy - Developmental

Procedure:

Step I - Suggest to children that they could pretend to be one of the alphabet letters by using their bodies to form the letters. They should do this by themselves, taking turns.

Step II - Ask what letter two or three children could form together. Encourage them to demonstrate a few. Use visual stimuli for both steps if necessary.

d. Content - large samples of the letters

Activity: Fire Engine

1. Learner Outcome - To enhance the flexibility and agility

2. Conditions
   a. Learner Characteristics - 6 to 8 year olds
   b. Situation Variables - on a playground or in a wide open area as a group
   c. Strategy - Directive

Procedure:

The game is called Fire Engine. Have the children line up and count off by 5's. Each group of five is given a name (e.g. North Firehouse) and they then line up vertically facing the direction they will run. One child is the Fire Chief. He yells out, "Fire Engines No. 1, Get Ready!" All the one's come to the line, ready to race. The Fire Chief then yells, "Engines No. 1 ready - FIRE!" (He also blows a whistle.) The No. 1's run down to the opposite side and run back, getting in line again. The first one back becomes the new Fire Chief. All numbers are eventually called. At the end, a general alarm is called where everyone races down and back, getting back into their original groups. The first group back is the winner and the firehouse that put out the fire.

d. Content - None, except a safe open area.

Activity: Rubber Ball

1. Learner Outcome - To develop flexibility by rolling, twisting, and turning

2. Conditions
   a. Learner Characteristics - normal preschoolers
   b. Situational Variables - group activity
   c. Strategy - Directive

Procedure:

The teacher demonstrates then directs the child in making the correct movements.

Please sit on the floor, bend your knees, and put your feet on the floor ahead of you. Put your arms down between your legs and hold your left ankle with your right hand and your right ankle with your left hand.

Put your feet and knees as close together as possible and pull your knees up tight against your chest. Now you look just like rubber balls and can roll just like a rubber ball, too. First roll on your back. Then roll onto one side, so your shoulder, hip and knee touch the floor. Now roll forward so both your knees are touching the floor and your face is looking straight down at the floor. Now roll onto your other side, then roll over onto your back, and finally roll back into your original sitting position.

d. Content - soft surface as a carpet, lawn, or exercise mat.

3. Resource - Launch

The following activities may develop flexibility.

Writing Behind (Spine; leg muscles) :
The children stand bent forward with feet wide apart. They reach back through their legs as far as possible and make a mark on the floor with a piece of chalk. At each attempt they try to make a more distant mark.

Leg Swing (Spine; hip joints) :
1. The children stand upright and swing one leg back and forth. Repeat with the other leg.
2. As 1, but the children swing each leg sideways.
3. As 1, but the children make circles with each leg.
4. As 1, but the children swing each leg far out in front so that it forces them to take a forward step. They continue with these "giant" steps across the room or in a circle.

Elephant Walk (Spine) :
The children link the fingers of both hands and bend forward at the waist, letting the arms swing loosely. They take a heavy step with the right foot, swinging the arms to the right; then a heavy step with the left foot, swinging the arms to the left. They continue walking in this way. The swinging motion should pull the body forward.

Ankle Hold Walk (Hips; legs) :
The children bend forward, keeping knees straight, grasp ankles, and walk forward. If this is too difficult, the children should first do the exercise holding their calves.

Balance

Balance involves the ability of an individual to amintain equilibrium relative to gravity. It is the state of stability produced by an equal distribution of weight on each side of a vertical axis, and is most often affected by altering the location of the center of gravity relative to the base of support. The center of gravity is generally located within the region of the midpoint between the hips. The body is in balance when this center of gravity and the line of gravity are squarely over the supporting base. The base of support may be defined by the position of the body parts in contact with the surface (generally the two feet) and the area between those contacting parts. If the vertical axis or line of gravity falls near the center of the base of support then the body will be in balance.

The maintenance of good balance depends upon the interaction of the following primary systems:

muscular feedback from the postural muscles (proprioceptive feedback).
information from the visual system which aids the child in locating his or her body in space.
information from the labyrinthian mechanisms (inner ear).

The basic physiological development of these three systems is relatively mature in the young child. It takes a great deal of experience, however, for the child to be able to "utilize" the information available from these systems. It is interesting to note, however, that the labyrinthine or vestibular organs are not fully developed until about age two or three (Smith, 1970). This is probably why motion sickness is rarely observed in infants under two years of age. The balance mechanisms, along with vision, tactile information, and data from the proprioceptors, enable the child to perceive the body's orientation in space. The visual mechanism is especially important in lessening the effects of vertigo allowing visual focusing on the point surrounding the spinning activity.

Balance is not a constant factor, but an everchanging component of total body movement and is affected by the changes in the location of the center of gravity relative to the base of support and by gravity. The following forms of balance have been identified:

static balance - the child must balance upon a stable base of support (i.e., standing on tip-toes). The earliest form of balance is the ability of the child to sit up and then to maintain an upright posture while standing.

dyamic balance - the child must maintain a position on a moving surface or while the body is moving. This occurs when the legs are moved in any direction causing locomotion, or in such activities as walking on a balance beam, hopping, etc.

object balance - the child must give minimal support to something without letting it fall, such as balancing a stick or ball on the finger.

The child's ability to balance should develop as the result of a variety of experiences. However, in children with severe problems, Cratty (1967) suggests that balance will not improve without specific experience or practice. The ability to balance is extremely important to all children because it underlies almost all complex motor skills, such as throwing, running, skipping and catching. The ability to balance one's body while performing is not only necessary to the efficient execution

of the various motor patterns, but also to the safety of the child during many perceptual-motor activities.

Measures for balance. The following instruments may be used to assess balance:

Kephart, N. C. The Obstacle Course subtest provides an estimate of the child's awareness of the position of his body in space.

Kephart, N. C. The Walking Board subtest of the Perceptual Survey Rating Scale provides a measure of balance.

Seashore, H. G. The development of a beam-walking test and its use in measuring development of balance in children. Research Quarterly, 1947, 18, 246-259. This provides a measure of dynamic balance.

Ontogeny and Appropriate Equipment for Balance

Age in Months		Appropriate Equipment	Potentially Hazardous Conditions
4.8-8	Can sit without support and hold head steady and set forward (W&L). (Bayley) (Denver).		
5-12	Stands while holding on (Bayley). (Denver). (W&).		
9-18	Stands alone (Bayley). (Denver).		
11-20	Stands on right feet with help (Bayley).		
12-23	Stands on left foot with help (Bayley).	Games or stunts which involve single leg balancing.	Keep play area clear of objects which might be fallen upon.
13-26	Tries to stand on walking board (Bayley).	Walking board Line of bricks Low balance beams	Keep walking boards near the ground to prevent falls.
15-29	Walks with one foot on walking board (Bayley).		Keep area around walking board clear of objects
15-36	Stands on one foot momentarily (Bayley), (Berry) (LDS).		
18-24	Squats to play, balancing without hand support (LDS).		
18-30	Walks on line, general (Bayley).	Games with paths or lines to walk on or near the ground	Check objects for sharp edges
19-30	Stands on walking board, attempts step (Bayley).		

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
21.7-39	Balances on one foot for one second (Denver).		
21.6-51	Balances on one foot for five seconds (Denver).		
24-30	Walks on walking board, alternates steps part way (Bayley).	Balance beam or board which is elevated	
30-36	Walks on board slightly elevated from the ground (LDS).		
36	Walks up stairs, one foot per step holding rail. Can walk 3" balance board (Corbin).	Lofts	During later stages provide progressively greater increments between steps
36-39	Balances on one foot for ten seconds (Denver).		
36-48	Stands on each foot 4-8 seconds (LDS) (Denver).		
36-48	Walks on 6" walking board with alternate steps and only 1-3 step-offs (LDS).		
39	Walks down stairs using rail, one foot per step. Walks one inch line forward and backward (MT).	Climbing boxes, stairs; steps Inclined plane.	Provide railing during initial stages
42	Walks up and down stairs, no rail, both feet to same step (MT).		
48	Remains standing, one foot advanced, eyes closed (OT).		
48-60	Stands on each foot more than 8 seconds (LDS).		

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
54	Walks up and down stairs, one foot per step, without rail support (MT).		
54	Walks with one foot directly behind the other and touching (MT).		
57	Stands on one leg for nine or more seconds. Walks full length on balance beam.		
60	Takes 10 steps on 2" balance beam (Keogh).	Balance beams of varying widths and distances	
60	Walks distances on tiptoe (CDP). Balance with feet together heels off floor for 10 sec. (OT) (Denver). Stands on one foot more than 8 seconds (W&L).		
60-108	With eyes closed, balances on each foot alternately (LDS) (W&L)		
72	Remains standing with weight one one leg for 10 seconds, eyes open (OT).	Pogo stick Stilts	Clear area of objects to prevent injury in case of fall
72	Takes 11-13 steps on 2" balance beam (Keogh).		Begin with small heights and progress to higher levels
72-84	Can walk on balance beam with occasional difficulty but is able to regain balance (Purdue). Can walk backward or sideward on balance beam but steps off more than 2 times in direction of movement (Purdue).	Walking board or balance beam Series of balance beams in a row	Avoid sharp edges or protruding objects
84	Balances on tiptoe bending forward from the hips (OT).		

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
96	Crouches on tiptoe (OT).		
108-120	Can walk backward on balance beam with occa sional difficulty but is able to regain balance (Purdue). Walks on balance beam (sideways, backward and forward) easily and maintains dynamic body balance (Purdue).		
120	Balances on tiptoe, eyes closed (OT).		

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Conditions to Develop Balance

Activity: Balance Beam

1. Learner Outcomes: to develop dynamic balance by using balance beam.

2. Conditions

   a. Learner Characteristics: Kindergarten class.

   b. Situational Variables: Individual activity on carpeted area in classroom.

   c. Strategy: Directive

      Procedure:

      Introduce walking board (or balance board). Say, "Today we are going to pretend we have a bridge over a pond of water. Try not to step off the bridge because we want to keep our feet dry." Whoe the children the heel-toe progression. Walk with the toes touching the heel in front. Ask the children to move slowly in order to stay on the bridge. Walk forward, backward, sidewise, walk forward and step over an object on the board, walk forward to the middle, pick up object, back up, walk on board to music, free exploration--child may want to do something of his own creation on board.

   d. Content: balance board; record player; record - "Let's Go Walking," from Making Music Your OWN, Kindergarten series, Silver Burdett Co. Object to pick up such as a bean bag.

   e. Resource: Halsey, Elizabeth, and Porter, Lorena, Physical Education for Children, (N.Y.: Holt, Rhinehard, and Winston, 1963), pp. 56-57.

Activity: Eraser Tag

1. Learner Outcome: to create an awareness of speed and balance.

2. Conditions:

   a. Learner Characteristics: Six to 8 year olds.

   b. Situational Variables: In classroom as group activity.

   c. Strategy: Directive

      Procedure: Explain game. Rules are similar to tag rules, i.e., the person IT chases other person. Once tagged, the other person becomes IT, thus changing roles. As soon as eraser falls off head, new person is chosen to replace the former.

   d. Content: Two standard size blackboard erasers.

Activity: Movement

1. Learner Outcome: to encourage individual movement exploration and thereby developing the ability to maintain balance on moving and still objects.

2. Conditions:

   a. Learner Characteristics: Preschoolers

   b. Situational Variables: Individual and group activity done in a large sparsely furnished room or outside.

   c. Strategy: Developmental

      Procedure:

      Set out equipment and let children interact with it in any ways they wish. Encourage children to use all of the equipment, and give physical help only if necessary. Encourage children to talk about what they are doing as they do it.

   d. Content: Balance Board, balance beam, large open plastic cubes, jump ropes, balance boat (?) seesaw type, Hula Hoop.

Activity: Hopscotch

1. Learner Outcome: to develop dynamic balance through alternating shifts in the center of gravity of the body.

2. Conditions:

   a. Learner Characteristics: 6-8 year olds

   b. Situational Variables: Individual or small group activity

   c. Strategy: Directive

      Procedure:

      Draw a square about 1' x 1' with chalk on the sidewalk and ask each child to hop in and then out with one foot. Draw 2 more squares and ask each child to then hop into the 1st square, then jump into the 2 squares with both feet, and then to hop out again. Continue adding alternating hops and jumps until a pattern of 4 single squares and 3 sets of double squares is completed. At this point ask the children to take turns going through the whole pattern. If they seem interested, describe the rules of regular hopscotch, adding numbers to the squares and demonstrating how to throw a stone in a square to win a turn.

   d. Content: chalk, several stones

Activity: Animal Walk

1. Learner Outcome: to develop dynamic balance by moving at various speeds.

2. Conditions:

   a. Learner Characteristics: 6-8 year olds.

   b. Situational variables: group activity in classroom.

   c. Strategy: Directive

      Procedure:

      Teacher motivate child to experiment by showing various animal pictures and discussing how animal moves:
      the elephant walk--slowly, swaying from side to side shifting weight.
      the cat walk--quietly creeping on tip-toe
      the bunny hop--fast or slow jumping with feet together.

   d. Content: Animal pictures, elephant, bunny, cat, etc.

The following activities may also develop balance.

BALANCE (Static)
Standing on Tiptoe
For all tiptoe positions, the heels should be raised from the floor as far as possible.
1. The children stand, raise themselves to tiptoe position, hold for three to five seconds, and then return to standing position.
2. As 1, but as the children rise on the toes they slowly raise a ball high overhead, using both hands.

Balance Activities--Static balance while standing
a. Heel to toe balance
b. One foot balance
c. One foot knee high
d. One foot arms high
e. One foot eyes closed
f. One foot, eyes closed, arms folded
g. Combinations, eyes closed, knee-high, arms folded

Balance Beam Activities (Dynamic)
Beams are 2" x 4" x 20'. (Work from broad to narrow widths)
Beam may be used on a slant to increase difficulty.
1. Walk forward, sideward, backward--use arms for balance, short steps.
2. Same as 1, but add obstacle, such as small rope "snaked" over beam, children walk over, step carefully.
3. Turn on beam--use arms for balance (extended), turn on balls of feet, try with arms folded and behind back.
4. Cat walk--forward then backward on all fours.
5. Stand, sit on beam--extended arms for balance, leans forward and squats on one leg before sitting; to rise, leans forward to squat and then stands.
6. Travel sideways sliding feet--use arms extended for balance--slide feet, not a step over move.
7. Travel sideways stepping left over right foot or right over left; use extended arms for balance, shoulders parallel to beam.

8. Forward walking on 4" width--eyes on a moving visual cue. Teacher holds a ball, colored paper, etc. at performer's eye level and moves it at a speed determined by child. (Child is moving forward while teacher is moving backward) Forward walking with eyes on stationery visual cue at eye level. Forward walking with target directly on end on beam. Forward walking with eyes on a visual target moving vertically, horizontally, diagonally.

Balance Board Activities

Boards can be made easily from 3/4" plywood. 16" to 20" tops are generally adequate. A 1 1/2: x 1 1/2" base is recommended for dindergarten children. If tasks appear too difficult, a broader and shorter base (1" x 3") may be substituted.

1. Practice maintaining balance--with both feet centered on board, tilt forward and return; backward and sideward.
2. Repeat above sequence but keep eyes closed.

Agility

Agility refers to the ability of a child to react quickly with controlled efficient movement of the entire body while changing directions. It involves the ability to make successive movements in different directions efficiently and as rapidly as possible, or to adjust one's position quickly. Directional changes may be lateral, oblique, or complete reversals of the path of movement as well as changes in the level of the movement (high-low).

Agility is primarily concerned with the ability of the child to shift directions while moving, with grace, ease, comfort and economy. It may involve fine motor movement such as typing, drawing, or playing the piano, or more gross movements such as a zig-zag run.

The concept of agility emphasizes that the directional shifting of the body is fully under the control of the individual and utilized by the individual selectively and consciously for the purpose of solving the problem (Barsch, 1968). That is to say, the greater the agility of the child, the greater the options of movement to solve a given problem. This ability is especially important in activities requiring quick starts and stops, and changes of direction such as dodgeball, shuttle run, changing from sitting to standing, forward roll, figure-eight run, obstacle courses, swinging, rocking, and spinning.

Ontogeny and Appropriate Equipment for Agility

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
12-18	Runs stiffly and upright with eyes focused on ground. Can't go around obstacles (LDS).		
18-24	Can stop and start easily and avoids objects (LDS).	Obstacle Courses	Avoid hard soled shoes which lack sufficient traction
21	Runs well with only occasional falling (MS).		
24	Runs well with no falling (W&L).		
66	Runs a figure 8 course with good balance (Sinclair).	Tunnels Boxes	Slippery surfaces (highly waxed or oiled) floors
72	Runs 120' shuttle run in 13.8 sec. (Keogh). Runs zigzag (60') in 11.3-12.1 (Keogh).	Barrels and obstacles to traverse	
84	Runs 120' shuttle run in 13.1 sec. (Keogh). Runs 60' zigzag run in 10.1-10.4 sec. (Keogh).		

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
96	To run 5 meters, pick up a matchbox, make a square, etc. (OT)		
96	Runs 120' shuttle-run in 12-13 sec. (Keogh). Runs 60' zigzag run in 9.6-9.8 sec. (Keogh).		

Conditions to Develop Agility

Activity: Weave In, Weave Out

1. Learner Outcome - To increase agility by adjusting position while running

2. Conditions
   a. Learner Characteristics - 5-8 year old children
   b. Situational Variables - group in playground or gymnasium
   c. Strategy - Directive

   Procedure:

   1. Children form a circle and take one step back.
   2. One person is "It" and tags a person in the circle.
   3. "It" and the tagged player start weaving in and out of the circle, running in opposite directions.
   4. The first one back to the empty space wins.
   5. The other player is "It" for the next game.

   d. Content - none

3. Resource - Vannier, Maryhelen, and Foster, Mildred, Teaching Physical Education in Elementary Schools (Philadelphia, W.B. Saunders Co., 1964), p. 127.

Activity: Obstacle course

1. Learner Outcome - To develop agility of movement

2. Conditions
   a. Learner Characteristics - children ranging in age from four to twelve or more years, depending on the ability of the child and the difficulty level of the course.
   b. Situational Variables - large room with a lot of space for movement.
   c. Strategy - Directive

   Procedure:

   Show the obstacle course to proceed through. Some variation in the activity would be introduced by having children perform the course backwards. The course would include activities such as crawling under a table, stepping over blocks, walking on a walking board, and skipping or hopping from one activity to another.

d. Content - the materials needed include tables, benches, blocks, a walking board, etc., depending on what type of activities would be stressed.

Activity: Dodge ball

1. Learner Outcome - To develop agility and speed.

2. Conditions
   a. Learner Characteristics - children ages 6-8 with normal gross motor development.
   b. Situational Variables - group activity.
   c. Strategy - Directive

Procedure:

Two children roll the ball on the ground back and forth between them, trying to hit children in the group who are standing between them. The children in the group run when the ball is thrown so as not to be hit. If a child is hit, he is eliminated from the game. The game continues until the last child is hit.

d. Content - large plastic ball that is not too hard.

Activity: Drop the handkerchief

1. Learner Outcome - To increase speed and agility

2. Conditions
   a. Learner Characteristics - 6-8 year olds
   b. Situational Variables - group activity on playground
   c. Strategy - Directive

Procedure:

1. Have children stand in a circle facing the inside and not holding hands. (outside)
2. Teacher will take the handkerchief and be "it" first.
3. "It" runs around the outside of the circle and drops the handkerchief behind a child.
4. That child picks up the handkerchief and chases "it" around the circle to the vacant place.
5. Person who gets there second is "it" and game continues.
6. "Its" who get caught, stay inside circle and try to steal handkerchief.

d. Content - handkerchief

The following activities may also promote agility.

The Big Giant (Tag game)

One child, the Big Giant, lives in the meadow in the center of the playground. On one side of the playground are the other children, who want to cross the meadow to the forest on the other side.

The giant shouts, "Who's afraid of the big strong giant?" The children answer, "No one", and try to run across the meadow to the forest without being caught by the giant, who is not allowed to leave the meadow. Whoever is caught by the giant is the giant next time.

Launching the Rocket

From a crouch position, the children jump into the air, stretching their bodies and arms as far upward as possible. They land upright on their feet and stand still.

Duck Walk

The children waddle forward in crouch position. They hold their hands flat together behind their backs, fingers pointing away from the body to form a duck's tail.

This exercise should not be used for any extensive time, as it may overstrain the leg muscles. The teacher should have the children shake their legs after doing the exercise.

Kangaroo Hop

The children crouch, fingers touching the floor between their knees. They jump up and forward, bodies stretched, and land in a crouch position again.

At first the children should proceed in this way for short distances only, but the distances may be gradually increased as the movement becomes familiar.

Endurance

Endurance may be defined as the ability to sustain activity over a relatively long period of time. In general, the endurance of children increases with age as do most of the physical abilities. Lack of endurance does not present much of a safety hazard in most children unless the child is forced to continue activity beyond the psychological and physical limits which would indicate the necessity for termination of the activity. Historically, however, the "Child's Heart Myth" has been perpetuated. As early as 1879 Beneke warned of the dangers of repetitious work of the child's heart. He warned that children should refrain from vigorous exercise because of the "natural disharmony" between the development of the size of the heart muscle and the size of the large blood vessels (Corbin, 1973). On the other hand, Karpovich (1937), Astrand (1952), and others have shown that although the size of the major artery is smaller in proportion to the heart in young children compared to older children, the blood carrying capacity is proportionate to heart development. Corbin (1969) is even more emphatic and specifies that "a healthy child cannot physically injure his heart permanently through physical exercise" (Corbin, 1969, pp. 22-23).

The two major forms of endurance have been identified as muscular and cardiovascular. Muscular endurance refers to the ability of a muscle or muscle group to continue contracting over an extended period of time against a moderate resistance. It is closely related to strength, but differs primarily in that it involves a greater number of contractions with moderate resistance, whereas strength development involves fewer contractions with greater resistance.

Cardiovascular endurance refers to the ability of the human organism to supply oxygen to the working muscles and the ability of the muscles to utilize oxygen to support work. This type of endurance is enhanced by placing a stress on large muscle groups for an extended period of time through such activities as running, swimming and cycling. The circulatory and respiratory systems are taxed to a point where they are required to supply greater quantities of oxygen to the muscles so that they may continue work. The upper limits of cardiovascular capacity are illustrated in following table.

Age	Max. oxygen intake		Max. oxygen intake/Kg. body wt.		Max. H. R.	
4-6	0.88	1.1	47.9	49.1	204	203
7-9	1.50	1.75	55.1	56.9	211	208
10-11	1.70	2.04	52.4	56.1	209	211
12-13	2.31	2.46	49.8	56.5	207	205
					little sex differences	

Adapted from Per-Olaf Astrand, Experimental Studies of Working Capacity in Relation to Sex and Age. Copenhagen: Munkagoaard, 1952.

The child's development of endurance is reflected by the gradual decline with age of pulse rate and breathing rate, and the increase in ability to sustain muscular activity. By age 9 the pulse rate is rarely above 90 beats per minute and respiration is approximately 20. Children during these ages are characterized by being easily fatigued but they recover rapidly. As child development continues (usually by age 12), the heart rate is generally reduced to 80-90 beats per minute and respiration rate declines to 15-20.

PERCEPTUAL MOTOR ABILITIES

Perceptual motor abilities require the combination of perceptual, fine motor and physical abilities. Generally the skills which require coordination of visual perceptual and fine motor movements are revealed in school-related tasks (such as bead-stringing, drawing, writing, use of scissors, pasting, tracing, pegboards, puzzles, finger painting, brush painting, copying, and block-building) and self-help tasks (such as buttoning, hooking, tying, brushing and combing hair, bathing, brushing teeth and zippering). In addition perceptual motor abilities may involve locomotor skills such as jumping, hopping, running, skipping and galloping, which include a combination of perceptual and physical abilities.

Of the perceptual motor abilities that have received the greatest attention, the following are considered by Hurlock (1964) to be important.

Self-feeding - Interest in self-feeding is demonstrated during the latter part of the first year, when the child tries to hold a bottle or cup, or reach for a spoon. The child should be able to control all eating utensils fairly easily by ten years of age.

Self-dressing - The most rapid improvement in self-dressing occurs between 1-1/2 and 3-1/2 years of age, although most children cannot dress themselves completely until they are 5. Even then, children need visual input when manipulating fasteners on clothes, and are not able to manipulate such fasteners without aid of their eyes much before they are 6. It is at this time that fine motor skills are well-developed.

Writing - The development of writing skills in the preschooler follows a fairly predictable pattern, with the characteristic scribbling of the one to 2 year old considered to be the beginning stage. Fine muscle control needed for writing is not, however, well-developed much before 6 yrs.

Ball throwing and catching - As Gesell (1946) has pointed out: "Skill in throwing a ball requires a fine sense of static and dynamic balance, accurate timing of delivery and release, good eye-hand coordination, and appropriate functioning of the fingers, as well as the arms, trunk, head, and legs, in controlling the trajectory of the ball." Ball-throwing and catching is a complex ability, and, as such, is rarely well-developed as a skill before 5 yrs.

Equally important perceptual motor abilities include those of:

Locomotion - Locomotor skills involve movement through space and are characterized in general by coordinated and synchronous movements, attainment of an upright posture, and rhythmic patterns. All eight of the primary locomotor skills (walking, running, leaping, hopping, jumping, galloping, sliding, and skipping) follow a predictable sequence of development.

The extent to which these perceptual motor abilities are developed will be reflected in the usage of equipment in the child's environment. The child who has not attained the ability to use a knife to 'spread' butter on bread for example, will not be able to use a knife in the more complex cutting motion. To expose such a child to knives without supervision would thus be an unwise decision.

Learner Characteristics: Perceptual Motor*

Terminology	Characteristics (Garrison and Force, 1965)	Areas of Development Affected by LC	Conditions for Atypical Characteristics
dysgraphia	Inability to write letter or words, due to visual-motor integration difficulty	Eye-hand coordination: precision, and steadiness	
Erb's palsy	Upper arm/shoulder palsy present at birth	Eye-hand coordination: precision and steadiness, purposive skills: production and reception	
hemiplegia	Paralysis of one side of the body	Fine motor skills, eye-hand coordination, locomotor skills, purposive skills (both production and reception) (see learner characteristics for perceptual abilities)	
	For those learner characteristics affecting locomotor abilities and purposive activities, see section on physical abilities.		

*Many of the learner characteristics which would affect perceptual motor development have already been discussed within the context of perceptual and physical abilities.

Fine Motor Development

Fine motor skills involve the ability to integrate the movements of fingers, hands and wrists into a purposeful, synchronized pattern.

Developmental concerns in this area include manual dexterity and finger dexterity. Finger dexterity requires rapid, fine movements with the fingers. This development improves during the latter stages of proximo-distal growth. Oftentimes a child's finger dexterity can be evaluated under informal observational conditions. Cratty (1967), however, suggests specific evaluation tasks, including:

Finger opposition tasks - The child is asked to touch each of his four fingers with his thumb. In general, a 6-year-old can do this quite well, even with both hands simultaneously.

Matchstick placing - Matchsticks are to be placed in a matchbox under timed conditions, a task which most 4-5-year-olds can perform easily (Cratty 1967).

Manual dexterity is the ability to make rapid, but skillful and controlled arm and hand movements. It is not a uni-dimensional attribute but is composed of several sub-skills including finger dexterity, steadiness, and eye-hand coordination (Cratty, 1967). As such, discussion of this ability necessitates knowledge of these three areas.

Measures for fine motor development. The following tests may be used to assess fine motor abilities:

Bayley Scales of Infant Development, Bayley (1969). The scales (motor scales, mental scales, and behavior record) are designed to provide a tripartite basis for the evaluation of the child's developmental status in the first 2 1/2 years of life. The motor scale is designed to provide a measure of the degree of control of the body, coordination of the large muscles and finer manipulatory skills of the hands and fingers. Results are expressed as a standard score.

Denver Developmental Screening Test, Frankenburg, W. and Dodds, J. B. This test assesses gross motor, fine motor, adaptive language and personal - social development. It's intent is to detect serious developmental delays in young children.

Ontogeny and Appropriate Equipment for Finger Dexterity

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
1-6	Fingers hand in play (Bayley).		
4	Manipulates fingers (Cattell).		
6-9	Grasps objects with fingers (Cratty).	Objects that are small enough to grasp but large enough to prevent swallowing (e.g. spools, baby shapes).	
6-12	Fingers hole in pegboard (Bayley).	Squeeze toys.	Squeeze toys with squeakers that may be poked out.
8	Secures pellets (Cattell).	Larger objects with small indentations to aid in grasping.	Holes in toys should be non-existent or big enough to prevent fingers getting stuck.
8-18	Turns 2-3 pages of book at one time (Bayley).	Books with cardboard or oilcloth pages.	Paper cuts from paper pages.
9	Scissor grasp of pellet (Cattell).		
10	Plucks pellet easily with thumb and index finger (W&L). Index finger approach (W&L).	Boxes which can be opened and closed easily.	
11	Manipulates boxes and stones (Cattell).	Equipment with knobs and other devices to encourage finger dexterity. Pots and pans with lids.	Knobs constructed so they cannot be removed and thus reveal sharp objects. Small places where fingers can be pinched if object has moveable parts.
12	Probes holes and grooves, and points at pellet in bottle. Puts one or more cubes in a cup (Cattell). Unwraps a cube covered with a piece of tissue or cloth (Bayley).		

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
13	Neat pincer grasp of pellet (W&L)	Containers in blocks or smaller items (such as buttons) may be placed.	Plastic which breaks, providing places for fingers to be pinched.
15	Puts beads in box (Cattell). Puts ten cubes in a cup (Cattell). Picks up small items on sight with pincer grasp (LDS). Puts pellets in bottle (W&L).	Nesting cubes Plastic bottles with items to insert.	Small rigid apertures in which arms could get stuck.
24	Turns pages of a book one at a time. (W&L). Strings three one-inch beads.	Bead-stringing	See bead-stringing cautions in laterality section.
24-28	Unbuttons and buttons side and front (LDS).	Doll's clothing with large fasteners. Dressing frames to encourage use of zippers and buttons.	Avoid safety pins without supervision.
36	Hand tremor when fine coordination is required.	Large tinkertoys with color (wheels about 3" in diameter sticks about 1/2" in diameter.	
	Holds crayon with fingers	Art activities requiring larger muscle coordination, i.e., finger painting, brush painting, water color markers.	Non-toxic substances to prevent poisoning.
42	Manipulates most tiny objects with ease	Games involving finger grasp and release of tiny objects, such as marbles in box, cards, mazes with 3-dimensional objects. Woodworking with supervision Scissors	(Special) toys designed for safety (e.g. blunt scissors) are not always most useful and often impede development because they are more difficult to use and thus frustrate the child.
48-60	Laces shoes (LDS).		

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
54	Builds or puts things together requiring small muscles.	Smaller Tinkertoys in many shapes (not color) Lincoln logs, and other materials which encourage creative usage.	
60	Can imitate examiner's tying of piece of string around pencil (S-B). Can roll thread on a spool (OT). Can put 20 matches in a box, one by one, 10 with each hand (OT).		
72	Handles and attempts to utilize tools and material.	Woodworking without supervision art activities involving finer movements, i.e., mosaics, braiding, weaving, sewing cards.	
84	Manipulation of tools is somewhat more tense, but there is more persistence.		
96	Likely to be a gap between what he wants to do with his hands and what he can do. Can touch thumb to all fingers of same hand (OT).	Musical equipment (wind instruments, piano) Typewriter	Bad habits formed if introduced too early.

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Conditions to Develop Finger Dexterity

Activity: Typing the correct spelling of names in a picture

1. Learner Outcome: to improve finger dexterity.

2. Conditions

   a. Learner Characteristics: 7-to-8-year olds

   b. Situational Variables: Individuals at a spelling center with a teacher near for extra explanation

   c. Strategy--Developmental: Learning center

   d. Content:
      1. Materials:
         a. Typewriter on a table or counter;
         b. Paper
         c. Cards with pictures on them;
         d. Correct spelling of picture words on the back.
      2. Directions:
         a. Type the names of all the things in this picture.
         b. Sound them out as you type them.
         c. Check your answers with the words on the back of the card.

   e. Resources: none

Activity: Straw Pictures

1. Learner Outcomes: to improve finger Dexterity

2. Conditions

   a. Learner Characteristics: Group of 21 2nd graders ages 7 to 10; motivation--use of a new material.

   b. Situational Variables: Large group instruction at tables; use of straw.

   c. Strategy--Directive

      Procedure:

      1. Show the children the various things that can be done with straws--bending, twisting, cutting.
      2. Encourage children to think of different ways to use their straws for a picture.
      3. After children have finished, ask them to show their pictures and describe the different things they did with their straws.

   d. Content: straw pictures - 4 or 5 straws, glue, piece of construction paper for each child.

Activity: Giant Shoes

1. Learner Outcome: to develop finger dexterity and fine muscle control of wrists and arms by lacing a shoe.

2. Conditions

   a. Learner Characteristics: Appropriate children, ages range from 2 to 6 years.

   b. Situational Variables: Individual activity in classroom.

   c. Strategy--Directive

      Procedure:

      The child is shown the model pair of giant shoes. Verbal interaction follows between the child and the teacher; it is discussed that people wear a pair of shoes, one on the left foot and one on the right foot. The child in sock feet actually stands on the pattern in sock feet (tactile reinforcement). The teacher tells and/or solicits from the child how the shoes can stay on one's feet. They decide together that the shoes must be laced and tied (problem-solving). The teacher demonstrates with one shoe while the child watches. The teacher then slowly laces the shoe, step by step allowing the child to repeat after each individual movement.

      Developmental: This activity can become developmental. After several demonstrations by the teacher, the child can practice this activity whenever he elects to do so.

   d. Content: (a) two pairs of giant model shoes made of heavy cardboard; (b) two pairs of large gym shoe laces or colorful yarn to be used as laces.

Activity: Hand and Finger Play

1. Learner Outcome: to develop fine muscle coordination of fingers and hands

2. Conditions

   a. Learner Characteristics: 6-to 7-year-old children

   b. Situational Variables: Groups seated on the floor.

   c. Strategy--Directive

      Procedure:

      Motivate the children by telling them the story of Mr. Finger-Thumb: The fingers did not get along with the thumb at all. The fingers wanted so much to play baseball. They tried and tried to pick up the bat. They went under the bat and over the bat but the bat would not move. All at once when the thumb was under and the fingers were over the bat, it began to move. From then on the fingers decided it was a lot less work and took a lot less time if they would work together with the thumb. They called themselves Mr. Finger-Thumb.

      A picture of Mr. Finger-Thumb is an added motivator.

Procedure:

Explain to the children that Mr. Finger-Thumb has written us a game in which their fingers and thumbs can work together:

Open them, shut them,
Open them, shut them.

Give a little clap!

Open them, shut them,
Open them, shut them.

Lay them in your lap.

Creep them, creep them
Creep them, creep them (move fingers up chest to chin)

Way up to your chin

Open up your little mouth

But do not let them in.

Open them, shut them
Open them, shut them

To your shoulders fly,

When like little birds,

Let them flutter to the sky.

Falling, falling, falling, falling.

Almost to the ground (bend down slowly)

Quickly fly them up again

And turn them round and round (hand over hand)

Faster, Faster, faster, faster

Slower, slower, slower, slower,

Clap!

Activity: "Fingers"

1. Learner Outcome - To develop fine muscles in hands, wrists, and fingers

2. Conditions
   a. Learner Characteristics - appropriate for children aged from 2 to 6 years

b. Stiuational Variables - small group activity (6 to 10 children) in classroom

c. Strategy - Directive

Procedure:

Ask the children how many hands they have. Ask them how many fingers they have on each hand. Ask them to count the number of fingers they have. Tell them that you are going to play a game about "fingers" and that you want them to watch your actions and listen carefully as you repeat and dramatize the finger play. After the teacher demonstrates once let the children go through the activity with her. Repeat the action and verse several times until the children have mastered the activity or until they grow tired.

d. Content - fingers

I have ten little fingers and they all belong to me.
(Hold up both hands with outstretched fingers.)
I can make them do things, would you like to see?
(Continue holding up both hands.)
I can shut them up tight, (Close hands tightly) or open them wide (open hands again).
I can put them together (bring hands together in center of body) or make them all hide (carry both arms behind body).
I can make them go high (quickly push both arms up in the air).
I can make them go low (quickly push both arms down to the side).
I can fold them up quietly and hold them just so.
(Clasp hands together in center of the body and hold them erectly.)

Ontogeny and Appropriate Equipment for Manual Dexterity

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
1	Hands predominantly fisted (W&L). Hand clenches rattle placed in palm, but does not retain	Because the ontogenetic gradients for manual dexterity are task-oriented, it is difficult to suggest appropriate equipment, as such equipment is implied in the stages.	Refer to potentially hazardous conditions for finger dexterity.
1-5	Manipulates red ring (Bayley).		
2-7	Manipulates table edge (Bayley). Ulnapalmar prehension (no thumb). (Bayley).	This column is, therefore, sketchy.	
3	Hands are open or loosely fisted (Reflexive Palmer Grasp).	Rattles, mobiles, cubes, rings.	
3-7	Retains 2 cubes in hand (Bayley).		
3-9	Grasps rattle (Denver).		
4	Holds rattle actively. Grasps cube on contact (Gesell). Grasps ring when it is held near his hand (Gesell).		
4-8	Partial radial-palmar prehension (Bayley).		
4-10	Retains 2 of 3 cubes offered (Bayley).		
5	May transfer object from hand to hand (Cattell).	Baby shapes	
5-8	Rakes raisin.	Cereal	
5-14	Tries to secure 3 cubes (Bayley).	Lots of objects of many sizes and textures which child can pick up and experiment with in terms of hand transference, banging.	Breakable objects could become lethal.

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Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
6	Begins to exploit objects by shaking, hitting, etc. Also drops and throws objects (Cratty).		
7	Makes direct approach on pellet, hand comes within vicinity of pellet and rakes (Gesell). Alternation of prehension and manipulation, which may result in transfer (Gesell). Holds one cube and grasps another (Gesell).		
10	Drops cube with clumsy or exaggerated release (W&L). Picks up cube and releases in vicinity of another (Gesell).	Design cubes	
12	Grasps cube in one hand, transfers to other and manipulates. Releases cube adaptively.		
12-18	Lifts and holds cup between 2 hands (LDS).	Cups with two handles.	
18-24	Holds small glass with one hand as he drinks (LDS).	Plastic glasses, paper cups.	
24	Uses fork and spoon to eat (Hurlock).		
36	Able to spread butter or jam with knife (Hurlock).		
48	Can cut with knife (Hurlock).		

Conditions to Develop Manual Dexterity

Activity: Circle pictures

1. Learner Outcome - To develop manual dexterity by manipulating and bending small objects.

2. Conditions
   a. Learner Characteristics - preschoolers
   b. Situational variables - individual or small group activity
   c. Strategy - Directive

   Procedure:

   Discuss the concept of a circle, looking at some pictures of circles. Have children draw big circles with their arms. Explain that they are going to make circle pictures, first by drawing lots of circles of all sizes on a piece of construction paper. Then the child is given some pipe cleaners and shown how to manipulate them into circular shapes which will then be pasted on the picture wherever the child desires.

   d. Content - construction paper, crayons, glue, pipe cleaners.

Activity: Play Dough Creations

1. Learner Outcome - To develop manual dexterity fine muscles through use of a new medium.

2. Conditions
   a. Learner Characteristics - 6 to 8 year olds
   b. Situational Variables - small group
   c. Strategy - Developmental

   Procedure:

   Play Dough Recipe - mix 3 cups flour with 1/4 cup salt. Add 1 cup water. Add more water if too stiff; more flour if too sticky. Let children help with the mixing and measuring. Also needed - measuring cup, mixing bowl, large spoon, food coloring, and newspaper.

   d. Content - ingredients as above

3. Resources - An Activities Handbook for Teachers of Young Children, Doreen J. Croft/Robert D. Hess, p. 87.

Activity: Egg Shell Collage

1. Learner Outcome - To develop skills in manipulating small objects

2. Conditions
   a. Learner Characteristics - 6-8 year olds
   b. Situational Variables - group activity in classroom.
   c. Strategy - Directive and developmental

   Procedure:

   Each child's egg shells are his own. He has hard-boiled them, colored

them, found them in an egg hunt, and eaten them. He will now use his shells in a collage.

Cardboard squares are cut for each child (1 each). Each child draws a picture on the cardboard (preferably one or two large objects with lots of detail). After the picture is completed each child applies glue to a small section of his picture. He then takes a small piece of shell and presses down, cracking it into the glue. He does this until as much of his picture has as much egg shell as he wants. The child may paint, wet chalk, etc. the rest of the board.

d. Content - cardboard, egg shells, glue.

Activity: Spring Blot Painting

1. Learner Outcome - To develop manual dexterity.

2. Conditions
   a. Learner Characteristics - 7-9 year olds
   b. Situational Variables - groups of 8 to 10 children at large tables
   c. Strategy - Directive

Procedure:

1. Children in their spot at table. Demonstrate project emphasizing rubbing with fist, away from fold, lifting fist and bringing it back to fold before rubbing away from fold again. Discuss color and what resulted when mixed.
2. Each child is given piece of manila art paper 12"x18" and choice of three colors out of six available. Medicine dropper in each color. Fold paper on own. Drop pools of 3 colors in crease. Fold over. Begin rubbing at fold away from fold to opposite edge of paper. Repeat 3-4-5 times. Open paper. Discuss results. If necessary add another few drops and repeat process.
3. Decide on spring title. Make second one on their own if desired.

d. Content - newspaper, manila paper, tempera paint, droppers, marker for title of picture.

Activity: Making own name with styrofoam packing material shaped

1. Learner Outcome - To develop manual dexterity.

2. Conditions
   a. Learner Characteristics - 7 to 9 year olds.
   b. Situational Variables - each child at own working spot, working at own speed.
   c. Strategy - Directive

Procedure:

Children watch from desks. Demonstrate project to group. First spelling a name with the pieces on a colored construction paper background. After pieces in place and name is spelled out, dip pieces one by one in Elmer's glue and replace in position to dry. (Paste will not do - will

not hold when dry.) Let dry flat and then hand individually or display on large mural-sized colored roll of paper in hall, whichever class decides to do.

d. Content - large supply of white styrofoam packing material; Elmer's glue; colored construction paper 12"x18" at least.

Visual-Fine Motor Development

Visual fine motor development involves the ability to coordinate movements of the body with vision. Perceptual judgments which hands make and the accuracy with which hands and fingers move are inseparable. This area of development is also affected by the proximo-distal growth in motor movements.

Developmental concerns in this area include coordination of eye-hand movements, precision of eye-hand movements and steadiness. Tasks which involve coordination between eye and hand are said to require eye-hand coordination. Ability in this area is revealed in school related tasks such as bead stringing, drawing, writing, use of scissors, pasting, tracing, pegboards, puzzles, finger painting, brush painting, modeling objects from clay, coloring within lines, copying, block building, and in self-help tasks such as buttoning, hooking, tying, brushing and combing hair, bathing, brushing teeth, and zippering. In gerneral, there are four phases of development in eye-hand coordination (Cratty, 1970). The first phase is that of object and hand regard. A child's use of his hands will emerge only after such observation, along with random hand-arm movements has occurred. Interestingly enough, White and Held (1964) have found that children who were not given much attention (handling) began to regard their hands earlier than an experimental group who received much handling and stimulation. The second phase in the development of eye-hand coordination is that of general motor excitation when confronted with an object, with no attempt to contact it. Such motor excitation is usually revealed in vertical arm movements (either alternately, separately, or together) and occurs somewhere between two and four months. Contact and manipulation is the third phase often beginning in the early part of the fourth month. It is during this stage that the child begins to examine and exploit objects. The latter stage, occurring after 6 months, involves exploitation of objects. Xuch exploitation is seen in the excessive amount of shaking, hitting, tearing, pulling, squeezing, rubbing, pushing, etc. of all objects. The child in this stage also begins to drop and throw objects, exploring the many ways such objects land on various surfaces. Somewhere around eleven months, still in the exploitation stage, he uses objects to make social contact.

The ability to handle small objects and to transfer them precisely from place to place is referred to as precision of eye-hand movements. This ability involves a very specific eye-hand movement. It differs from finger dexterity in that it is measuring the speed of eye-hand coordination (and is thus dependent on eye-hand coordination). Steadiness is the ability to aim the hands and fingers with precision. This ability involves eye-hand coordination but with the additional factor of steadiness. It is related to strength, level of tension, and emotionality. For example, the game of "pick-up-sticks" requires eye-hand coordination, precision and a steady hand which will allow the child to pick up one stidk without moving any others. It is obviously a higher level of visual motor development, underlying such skills as handwriting and typewriting.

Measures for visual-fine motor development. The following tests may be used to assess visual-fine motor development:

Beery, K. E. and Buktenica, N. A. The Developmental Test of Visual-Motor Integration. The Developmental Test of Visual-Motor Integration (MVI) consists of a series of geometric forms to be copied with pencil and paper. The VMI measures the degree to which visual perception and motor behavior are integrated in young children, a skill essential to beginning wriging activities. The copying of geometric forms is well suited to this purpose because, unlike letter forms, they are equally familiar to children of varying backgrounds.

Although the VMI can be easily administered by a classroom teacher, it is widely used by school psychologists and other testing specialists. The VMI is

primarily used with preschool through grade 3 students, although the Administrator's Manual provides normative data for children ages 2 through 15. The format of the VMI is suitable for both group and individual administration. Testing takes approximately 15 to 20 minutes.

Koppitz, E. M. Bender Developmental Scoring System. The Bender Gestalt Test for Young Children. New York: Grune and Stratton, 1964. A perceptual and projective test for children ages 5 through 10. The Bender Developmental Scoring System is an objective measurement of responses children make to the Bender Visual-Motor Gestalt Test. The test is administered in the usual way, but the drawings are examined for the presence or absence of certain characteristics on the basis of thirty mutually exclusive scoring items subsumed under seven categories: distortion of shape, notations, circles for dots, perseveration, integration of parts, angles and curves, and incorrect angles. Examples of the errors and instructions for interpreting the scores, normative data are provided to compare the child's performance to that of others who are similar in chronological age, maturation in the visual-motor perception and grade level.

Lowenfeld, V. Draw-A-Scene Test. Creative and Mental Growth, New York: The Macmillan Company, 1952. For children ages 2-17. A framework that can be used to evaluate the spontaneous drawings of children to get measures of group in intellectual, emotional, social, perceptual, physical, and esthetics and creativity.

Scribbling stage - (2-4)
Preschematic stage - (4-&)
Schematic stage - (7-9)
Gang stage - (9-11)

Also see Developmental Test of Visual Perception - Frostig, discussed under "Measures for visual constancy."

Ontogeny and Appropriate Equipment for Coordination of Eye-Hand Movements

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
2-3	Accurate swiping of object when he sees it (White and Held).	Because the ontogenetic gradients for eye-hand coordination are task-oriented, it is difficult to suggest appropriate equipment as such equipment is implied in the stages. This column is thus sketchy.	
3-4	Alternates glances from object to hand (White, et al.). Clasps hands at midline while glancing at object (White and Held). Glances at rattle in hand when it moves.		
5-6	Carries ring to mouth (Bayley).	Large soft things that can be chewed.	
4.9-5.0	Reaches for object (Denver).	Rattles which are visually appealing Tube rattles Mobiles	Breakable rattles with small pieces inside.
4.9-8.8	Feeds self a cracker (Denver).		
5	Picks up spoon (Cattell).	Cups, spoons, baby shapes	
6	Regards handle of cup, and may approach it but not prehend it (Gesell).		
6-7	Picks up cube (Bayley) although crudely (White and Held). Regards toy in hand and takes to mouth (W&L).		
7-12.3	Bangs 2 cubes (Denver).		

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
8	Pushes one cube with another (Gesell).	Push toy	
9-18	Puts 3 or more cubes in cup (Bayley).		
11	Pulls ring by string to appropriate distance for grasp. (Gesell) Also dangles a ring by the string (Bayley).	Pull toys with strings. Twirling mobile	String short enough to prevent potential entanglement
11-20	Puts 9 cubes in cup (Bayley).		
11.9-24.1	Scribbles spontaneously (Denver).	Crayons	Non-toxic substances
12	Marks with pencil (Cattell).		
13	Can put peg in pegboard (Cattell).	Jumbo pegboards (See 'finger dexterity')	
13.3-23.5	Uses spoon (OT).		
15	Frequently holds object up near eyes or out at arm's length.	Boxes of many shapes and sizes. Jack-in-the-box Dolls	Rough edges which could cut or tear skin.
15	Scribbles spontaneously (Denver).	Water color markers Crayons	
18	Picks up tiny pellet and places in a bottle with demonstration. (Denver) Places round and square blocks in formboard (Bayley).		
20.1-36	Dons shoes (Denver).		
21	Puts large pegs in a pegboard. Covers square box (Cattell). Folds paper once after demonstration (Gesell).	Jumbo pegboards and pegs	
24	Strings three 1" beads. Beginning to screw toys, and to turn doorknob. Attempts to fold paper (Cattell).	Pegboards, beads, objects with knobs	See 'finger dexterity'

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
27	Places geometric shapes into 3-hole form board (Gesell).	Sorting boxes with 2 or 3 shapes.	
30	Can solve 2 piece puzzles (McCarthy). Copies vertical lines (Beery) (Denver). Imitates both horizontal and vertical crayon strokes (Gesell).	Puzzles Easel painting	Too many pieces frustrate child.
36	Strings 4 or more beads in two minutes (Cattell). Can string beads of 3 shapes in any codes. Confines painting to own paper. Cuts with scissors functionally, but not necessarily easily or correctly. Places tiny pellets into a bottle (ten in thirty seconds). Can solve 3 piece puzzle (McCarthy).		
48	Easily uses scissors but does not necessarily follow lines.		
48	Puts 20 coins in a box (OT).		
54	Solves 4+ piece puzzles (McCarthy). Generally catches rolled balls.	Puzzles	
60	Can imitate folding of paper into triangular shapes (S-B). Cuts with scissors following a line. Likes to color within lines, to cut and paste simple things.		

Conditions to Develop Coordination of Eye-Hand Movements

Activity: Stain-glass jars

1. Learner Outcome - To develop eye-hand coordination by pasting.

2. Conditions
   a. Learner Characteristics - preschool aged children
   b. Strategy - Directive

   Procedure:

   The teacher tells the child to paint the glue mixture over a small part of the jar. Then the child places one tissue square on the glue. This procedure is followed until the entire jar is covered. A stain-glass effect is produced.

   c. Content - baby jars, 1" colored tissue paper squares, mixture of 1/2 water and 1/2 Elmer's glue, and 1 paint brush.

Activity: Sponge Painting

1. Learner Outcome - To develop eye-hand coordination

2. Conditions
   a. Learner Characteristics - 4-6 year olds
   b. Situational Variables - small group activity no more than 1:5.
   c. Strategy - Developmental

   Procedure:

   Newspapers are spread out on the tables. Teacher distributes large size construction paper to the children. Place 6 bowls of paint, only 3 different colors (2 bowls of each color) on the tables and place a 6" x 3" sponge in each bowl. Explain to children that each sponge may only be used for the color paint in which it is originally dipped. Demonstrate how to dip the sponges into the paint and then reproduce a design on the paper. Allow them to create their own masterpieces!

   d. Content - newspaper, construction paper, sponges, paint, smocks, paper towel.

Activity: Weaving

1. Learner Outcome - To develop skills in eye-hand coordination, by weaving

2. Conditions
   a. Learner Characteristics - 6-8 year olds
   b. Situational Variables - small group activity
   c. Strategy - Directive

   Procedure:

   Each student gets a loom. (Heavy cardboard cut at the ends was used). (Figure 1). The loom is then strung with heavy string (Fig. 2). The students put in their yarn leaving a tail. They are taught to go over, under, over, under. The whole loom is done this way. Everytime a new

piece of yarn is used a tail is left to be tied in at the end. If one now ends up under he must start the next row going over first. The child decides what it will be when he finishes. We had place mats to purses. The teacher cuts the loom string and crochets the ends.

d. Content - loom, heavy string.

Activity: Colored Corn Meal Pictures

1. Learner Outcome - To develop eye-hand coordination.

2. Conditions
   a. Learner Characteristics - 3 to 6-year olds.
   b. Situational Variables - in classroom; group or individual activity.
   c. Strategy - Developmental

   Procedure:

   Let the children paint on the construction paper with the glue, using Q-tips as a brush. While glue is still wet, let the children sprinkle the corn meal over the paper, shaking off the excess corn meal.

   d. Content - construction paper, white glue, Q-tips, corn meal mixed with dry powdered paint.

3. Resource - Croft and Hess, An Activities Handbook for Teachers of Young Children, p. 90.

Activity: Collages

1. Learner Outcome - To improve eye-hand coordination by cutting and pasting.

2. Conditions
   a. Learner Characteristics - 5-7 year olds
   b. Situational Variables - small group activity
   c. Strategy - Developmental

   Procedure:

   1. Use of a teacher-made model of collage to stimulate interest.
   2. Encouragement as they work.
   3. A varied and eye-catching supply of material should always be made available.

   d. Content - construction paper (for background), large boxes of scrap paper, magazines, material, ribbon, etc., paste, and scissors.

The following activities are also appropriate to develop eye-hand coordination.

Vertical and Horizontal Lines

Chalkboard activities require the child to use his eyes and hands as a team. He sees the trace made by his gross movements as he scribbles, and as he is able to bring fine muscles under control, he can produce shapes as he visualizes.

Scribble. Make a line like this, top to bottom. Go back to the top. Top to bottom. Top to bottom, top to bottom, top to bottom.

Double Circles

1. Stand on both feet - look at chalkboard
2. Lean forward until your nose touches the board. Mark where it touches the board.
3. Pick up your chalk. Hold it in both hands. Place your chalk on the chalkboard.
4. Keep looking at your mark; start at the top and makes circles until I say stop. 1, 2, 3, 4, stop.

Developmental Drawings

These drawings require the child to use his eyes and hands as a team. He is able to bring fine muscles under control; he can produce shapes as he visualizes them.

Make a circle: start at the top, go around and close
Draw a cross: top to bottom; then left to right
Make a square: go down, stop; across, stop; up, stop;
Make a triangle: slant down, stop; across, stop; slant up, close.

Suspended Ball

Requires the child to follow a moving target and respond in terms of the target. It requires accurate timing and a synthesis between the visual system and the motor system.

1. Look at this beach ball. With one finger touch the red color on the ball. Touch it quickly with one finger.
2. Hold your head still; keep your eyes on the ball. Let your finger follow the ball as it moves. When the ball moves farther, your finger will move farther.
3. Hold your head still and watch the ball. Touch the ball with one finger when it gets in front of your face. Touch the ball with your finger when I say "Now".

Bean Bag Activities

Throwing the bean bag requires the child to fixate on a target. When catching a bean bag, he must follow the moving bean bag with his eyes. He learns to use his eyes and hands as a team. In doing this, he is required to use body control and also to make space judgment.

Ball Activities

Throwing the ball - fixate on a target. When catching a ball, he must follow the moving ball with his eyes.

Ontogeny and Appropriate Equipment for Precision of Eye-Hand Movements

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
6-12	Frequently misses paper (LDS) while using crayon.	Each item in the ontogeny is self-explanatory in terms of equipment and has been discussed in previous sections on finger and manual dexterity. Crayons & Paper Large pegs. Foam shapes	
10-12	Places 1 round block in formboard (Bayley).		
10-17	Places 1 peg in peg-board (Bayley).		
12-26	Puts 2 blocks in form-board (Bayley).		
13-20	Puts 6 pegs in form-board (Bayley).		
19-30	Imitates vertical or horizontal lines (Bayley).		
36	Imitates drawing a vertical line 1-1/2" (McCarthy).		
42	Imitates drawing, a horizontal line 1-1/2" (McCarthy, Bayley).		
48	Imitates drawing (McCarthy).		
49 ♂ (42 ♀)	Imitates vertical horizontal cross (Beery). (42 Denver).		
49-72	Copies (Denver).		
51 ♀ 54 ♂	Imitates (McCarthy, Beery).		
55	Draws man in 3 parts. Imitates drawing (McCarthy).		
58-59	Copies oblique cross X (Bayley).		
63	Imitates triangle (Beery). (66-68 LDS).		

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
61-66	Copies open square and circle (Beery).		
72	Imitates drawing (McCarthy). (W&L).		
77	Directional drawing (Beery). (68-69 LDS).		
78	Imitates drawing (McCarthy).		
84	Trace through 2 mazes (OT). Three-dimensional ring (Beery).		
86 ♂ 89 ♀	Six Circle Triangle (Beery).		
91 ♂ 95 ♀	Circle and tilted square.		
96	Increase in speed and smoothness of eye-hand performance ( ).		
97	Vertical diamond (Beery).		
104 ♀ 107 ♂	Tilted triangles (Beery).		
113 ♀ 114 ♂	Eight dot circle (Beery).		
116 ♀ 120 ♂	Wertheimer's hexagons (Beery).		
121 ♀ 131 ♂	Horizontal diamond (Beery).		

Conditions to Develop Precision of Eye-Hand Movements

Activity: Tracing Geometric Shapes on paper

1. Learner Outcome - To develop precision of coordination.

2. Conditions
   a. Learner Characteristics - Four to nine or ten year olds, depending on their individual abilities.
   b. Situational Variables - small group of no more than 4 children
   c. Strategy - Directive

Procedure:

Give each child a piece of unlined paper and a pencil and ask him

to trace around a geometric shape made of cardboard or heavy paper.

d. Content - the materials would include the cardboard or heavy paper cut-outs of the geometric shapes (e.g., circle, triangle, etc.), unlined paper, and pencils.

Activity: Carpentry work

1. Learner Outcome - To develop precision in eye-hand coordination.

2. Conditions
   a. Learner Characteristics - 3 to 5 years olds
   b. Situational Variables - small group situation with no more than 3 in a group
   c. Strategy - Directive

Procedure:

Explain the use of each tool - its purpose and potentials - and show how it is used and then child will take the tool and use it correctly.

d. Content - materials used are the carpenty tool-kit, nails, and blocks of wood (including two large stumps of trees).

Ontogeny and Appropriate Equipment for Steadiness of Eye-Hand Movements

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
10-19	Tower of 2 cubes (Bayley).	(See previous sections)	
12	Spontaneously bangs one cube on another or places one next to another and, after demonstration, attempts to build a tower.		
12-18	Builds tower of 2-3 cubes (Denver).	Blocks, stacking equipment. Design cubes.	
15.5-26	Tower of 4 cubes (Denver).		
17-30	Tower of 6 cubes (Bayley).		
21-29	Tower of 8 cubes (Denver).	Blocks Lincoln legs	
30	Builds bridge wi: cubes (Cattell).		
36	Builds chair with cubes (McCarthy).		
42	Makes building with cubes (McCarthy).		
48	Builds house with blocks (McCarthy). Tends to combine cube-block structures in symmetrical form.		
108	Cuts out a circle (OT).	Scissors, paper	

Conditions to Develop Steadiness of Eye-Hand Movement

Activity: Pre-writing Movements

1. Learner Outcome - To develop steadiness of eye-hand movements.

2. Conditions
   a. Learner Characteristics - kindergarten children with no formal writing instruction
   b. Situational variables - group activity; teacher directed.
   c. Strategy - Directive

Procedure:

Tell the following story, inscribing the corresponding strokes suggested on the chalkboard. The children listen to the story, copying

these movements with a black crayon on large sheets of newsprint in front of them.

d. Content - large sheets of newsprint, black crayons, a chalkboard and chalk.

3. Resources - The story is taken from Phonics in Listening, Speaking, Reading and Writing, by Louise Binder Scott and J.J. Thompson.

Clouds

There are many clouds in the sky.

There are hills of clouds.

There are streaks of clouds,

seas of clouds,

and layers of clouds.

Rain comes straight down from dark clouds.

Sometimes it does not come straight down.

Sometimes it splashes this way:

Sometimes it splashes this way:

It makes little drops.

It makes middle-sized drops.

It makes big, big drops.

Activity: Macaroni Stringing

1. Learner Outcome - To develop steadiness of eye-hand coordination.

2. Conditions
   a. Learner Characteristics - 3-6 year olds
   b. Situational Variables - small group activity

c. Strategy - Directive

Procedure:

1. Show the child the macaroni.
2. Show the child some of the different ways that he can string the macaroni.
3. Let the child string macaroni.

d. Content - prior to the introduction of the lesson, teacher should procure some large sized macaroni suitable for stringing and tape the ends of the strings to prevent unraveling. The macaroni may be dyed differnt colors with food coloring. Set on a screen to drip dry speedily.

3. Resource - None

Activity: Stringing beads

1. Learner Outcome - To develop steadiness of eye-hand movements.

2. Conditions
   a. Learner Characteristics - 4-7 year olds.
   b. Situational Variables - individual or small group activity.
   c. Strategy - Developmental

Procedure:

Put three boxes of different sized and colored beads with large strings out for stringing.

d. Content - Beads and strings.

Locomotor Skills

Locomotor skills involve perceptual motor abilities which are primarily designed to transport the body through space. The most fundamental of the locomotor skills develops with the young child's ability to navigate in a prone position by the use of creeping and crawling. Probably no other neuro-muscular function of the growing infant exhibits so much individual variability (McGraw, 1945). In general, the infant progresses from relatively random flexion and extension of the arms and legs, to a rhythmic swaying motion, and then to the more mature crawling with arms and legs in opposition (simultaneous right arm and left leg forward, etc.).

The assumption of an erect posture is probably the key to the child's ultimate development of a variety of locomotor skills. The attainment of upright locomotor skills is determined by the ability to maintain the body in a balanced, upright position and by sufficient strength and flexibility to propel the body forward by alternate movements of the lower extremities.

The coordination of the arms and legs in a synchronized fashion is another important characteristic of upright locomotion. Coordinated movements are balanced and effectively timed functions of the entire body, and are most represented by the concept of symmetry implicit in the use of both sides of the body. This characteristic of symmetry is displayed in many actions where the movement is bilateral (as in the forward roll), or where the limbs move alternately and in an oppositional pattern (as in mature walking or running).

The specific rhythm of the movement is also a fundamental component of all perceptual-motor skills, but especially of locomotor movements. In general, locomotor movements have been divided into two groups (even and uneven) based on the nature of the underlying rhythm. Even locomotor skills (2/4 or 4/4 time) consist of the walk, run, leap, hop, and jump. The uneven locomotor skills (3/4 or 6/8 time) consist of skip, gallop and slide. Following, the reader will find a brief description of the locomotor skills. It is of particular interest to note that the uneven locomotor movements have identical rhythmic patterns, yet each of the three is recognizable as a unique pattern.

All three of the uneven patterns are generally accomplished between the ages of 2-5 and usually in a specific sequence (gallop, slide, skip).

walk - the transfer of weight from one foot to the other while moving forward or backward. One foot must always be in contact with the floor. In the mature pattern, the arms and legs are in opposition (right arm swings forward as the left leg steps forward)

run - the transfer of weight from one foot to the other (as in the walk), with a momentary loss of contact with the floor by both feet at the same time

leap - the transfer of weight from one foot to the other foot as in the run, but with a more sustained period of flight, greater height and distance. In the mature form, the toe is the last to leave the floor and the first to land.

hop - the transfer of weight from one foot to the same foot. In the mature form, the toe is the last to leave the floor and the first to contact again on the downward flight.

jump - the transfer of weight from one or both feet with a landing on both feet

gallop - moving in a forward direction with the same foot in front, in a step-close fashion

slide - moving in a sideward direction with the same foot always moving in the desired direction first. The weight is always transferred from the left foot to the closing foot.

skip - moving forward with a combination of long step-hop patterns which alternate the left foot

Each of the eight primary locomotor skills develop in a unique and relatively consistent sequence. This is not to say that individual variability across children does not exist (it is probably the rule rather than the exception), but rather that several general trends do exist. For example, walking skills develop in a very orderly progression, beginning with the inhibitory control over the neonatal reflex movements of the legs. Next follows the stamping leg movements and the deliberate supported forward steps of the infant. Independent steps follow, with the arms widely extended, knees flexed and feet widely spread. It is not until much later that the child will be able to assume the mature heel-toe progression and the arm motion in opposition to the legs. (McGraw, 1945).

Similarly, there are characteristic sequences identifiable in the development of running. Wickstrom (1970) identified a series of ten developmental trends in running.

1. Increase in length of running stride, resulting in increased speed.
2. Decrease in relative amounts of upward movement of the body for each stride.
3. Increase in the extension of the propulsive leg.
4. Increase in the amount of time in the non-support phase.
5. Increase in closeness of the heel to the buttocks on the forward swing of the recovery leg.
6. Increase in the height of the knee at the end of the forward leg swing.
7. Decrease in the relative distance the forward foot is ahead of the center of gravity when it makes contact with the ground.
8. Maintenance of a slight forward lean of the trunk throughout the stride pattern.
9. Extension of the support leg at the hip, knee and ankle to propel the body forward and upward into the non-support base.
10. Swing of both arms through a large arc in a vertical plane and in synchronized opposition to the leg action.

Developmental sequences for various types of jumping, hopping, and leaping skills have also been identified. For example, the following progression illustrates the child's ability during the orderly development of the complex skill of jumping (Wickstrom, 1970).

1. "Jump" down from one foot to the other foot
2. Jump up from 2 feet to 2 feet
3. Jump down from 2 feet to 2 feet

4. Run and "jump" forward from one foot to the other
5. Jump forward from 2 feet to 2 feet
6. Jump down from one foot to 2 feet
7. Run and jump forward from one foot to 2 feet
8. Jump over an object from 2 feet to 2 feet
9. Hop from one foot to the same foot rhythmically

Another form of locomotor skill is swimming. Although little information exists in the literature as to its developmental sequence, swimming-type patterns are evidenced in the newborn infant (McGraw, 1945). When the newborn is submerged in a prone position the organization of neuromuscular activity is striking. The child will remain in the prone position, with definite flexion-extension movements being demonstrated in both the arms and legs. These movements appear to be more highly organized than the creeping type movements and interestingly, the younger the child the more pronounced are the movements and the greater the inhibition of breathing efforts. After the first few months, the rhythmicity and organization of the pattern become somewhat dissipated; the movements appear more characteristic of struggling. The final stage occurs about the time of independent walking when the child will again make flexion-extension type movements. The final movements appear to be very purposeful and fairly well organized, but less automatic than the early reflex type movements (McGraw, 1945).

Swimming has most recently been conceived of as a natural pattern, whose development would be most efficient if pursued during early childhood. As the child grows older the natural swimming "reflexes" are over-ridden and the child must "learn" to deal with the water environment in a voluntary fashion. Concerns for child safety in the water are therefore much more prominent after the initial reflex stage.

Measures for locomotor skills

The following tests may be used to assess locomotor skills.

Carpenter, A. Measuring general motor capacity and general motor achievement in the first three grades. Research Quarterly, 1942, 13, 444-465. Carpenter General Motor Capacity Tests - This test provides an estimate of general motor capacity. Stunts and basic skills are assessed. Carpenter General Motor Achievement Tests - Through broad jump, shotput, and weight lifting activities, this test provides an assessment of general motor achievement for children in the first three grades.

Jenkins, L.M.A. A comparative study of motor achievement of children of five, six and seven years of age. Bureau of Publications, Teachers College, Columbia University Contributions to Education, 1930, 414, 16-17. Average scores on motor performances such as broad jump, hopping and throwing are provided for 5-7 year olds of both sexes.

Also refer to Orpet & Heustis' Movement Skills Survey discussed under "Measures for Flexibility".

Ontogeny and Appropriate Equipment for Locomotor Skills

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
5-11	Prewalking progression (Bayley).	Baby bouncer	Crushes, lacerations, and bruises from the frame or exposed joints or springs. (Also potential problem as child begins to walk if

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
5-11 (cont'd)			too much time was spent in the bouncer causes exaggerated bilateral extension thrust of legs associated with poor balance (Simpkiss & Raikes, 1972).
5-12	Crawls rapidly on all fours (LDS). Stepping movements (Bayley). Walks with one or both hands held (LDS). (Bayley).		
6	Travels by rolling, scooting, or creeping (MT).	Baby walker	Creeps to doors of room and into another to find parent.
6-15	Can creep up flight of 3 stairs (LDS) (W&L).	Large blocks, stairs	Moveable blocks without sufficient weight to provide a stable surface.
7.3-12.7	Walks holding onto furniture (Denver).		
9-18	Walks alone (Bayley), (Corbin); (9-17 Bayley). (Seldom falling-seldom falling		
11.3-14.3	Walks well (Denver).		
11.8-15	Walks without support (Denver).	Riding toys	Moveable parts which may cause pinches and crushed fingers.
11-20	Walks sideways (Bayley) (12-18 LDS).		
12.4-21.5	Walks backwards (Denver) (Bayley).		
12-15	Walks around room unattended with support (MT) (W&L).		
12-18	When walking, turns around poorly with circular path (LDS).		
12-18 b	Climbs forward into adult chair, then turns around and sits down (W&L).	Chairs and other furniture Rocking horse Obstacles-blocks, hollow barrels, cartons. Rocking chair	Firm base of support on furniture so that it won't tip over. Sharp objects (staples, nails, pins).

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
12-18	Can move homologous and alternate (LDS).		
12-18	Runs stiffly, upright, with eyes focused on ground, can't go around obstacles (LDS).		
12-18	Can carry large doll or teddy bear while walking (LDS).	Pull and push toys; house-keeping equipment	Sharp or breakable parts. Sharp or pointed ends on "pushers". Noise makers which become detached from toy.
12-24	Pushes and pulls toy a around floor while walking (LDS).	Large trucks, cars	
13-23	Walks down stairs with help (Bayley).	Stairs	
14.0-23.0	Walks up steps (Denver); with help (Bayley).	Inclined planes	Provide railing or support during initial stages.
17	Steps off (preliminary jump) an elevation (HR&C).		
17-30	Jumps with both feet (Bayley).		
18	Momentary suspension when steps (jump) down steps (HR&C).		
18-20	Walking stabilizes at 170 steps/min. (Corbin).		Provide increasingly greater increments between steps as skill progresses
18-30	Walks upstairs alone - makes time (Bayley).		
18-30	Walks on a line (Bayley).		
18-24	Climbs on furniture to look out window and can get down again (LDS).	Furniture Blocks	
19-36	Jumps from bottom step (Bayley) (W&L) (LDS).	Climbing boxes and frames Monkey bars	Beware of sharp objects (nails, stapes), pointed ends of poles, splinters from wood.

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
20.5-36	Jumps in place (Denver). Runs safely and can stop and start easily and avoid objects (LDS).	Obstacle courses; circuits to run.	Slippery surfaces.
	Jumps from second stop (Bayley).	Slide	Begin with little incline and reduced height.
21	Runs well with only occasional falling (MS).		
22-30	Distance jump 4-14 ins. (Bayley).		
23-30	Walks entire length of line (Bayley).		
24	Runs well, no falling (W&L). Jump from 12" height (M&W).		
	Walks up and down stairs with railing with both feet on same step (MT) (W&L).	Climbing boxes, stairs or blocks which can be arranged as stairs.	
24-36	Walks on slightly elevated board (Bayley) (Denver) (LDS).		
	Walks on 6' board with one foot on ground and one on board.	Balance beam Inclined plane, plank, etc.	Beware of sharp edges.
	Gallops (LDS) (Sinclair).	Hobby horse; broom stick horse.	
	Broad jump (Denver) (LDS)		
25-30	Distance jump 12-24" (Bayley).	Mat or sand to jump onto Lines or grid on floor	Beware of objects in the sand (rocks, glass). Check for slippery surfaces
26-36	Walk on tiptoes (Bayley) (Berry).		
27	Jump from height of 30 cm (Bayley).		
28	Jumps off floor with both feet (Bayley).		
28-30	Distance jump 24-30" (Bayley) (Denver).		
30	Jumps four or more times on bouncing board (Sinclair).	Jump rope Bouncing board	Check for sharp objects (Nails, staples, wire)

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
30-50	Walks down stairs alternating feet (Berry). (Bayley) (W&L)	Rugs Mats	
30	Learns forward roll and with a minimum of instruction (Sinclair).		Spotting techniques to avoid head and neck injury during intial stages.
31	Jumps from 18" height one foot (M&W)		
32	Jumps from chair (Berry). (Bayley).		
33-36	Jumps from 8" elevation (CDP). (M&W), with both feet.		
35-66	Backward heel to toe walk (Denver).		
36	Walks up stairs, one foot per step, holding rail (MT). Alternates feet going upstairs (W&L). Climbs over objects and obstacles such as furniture.		
36-48	Walks up and down stairs alternating feet (LDS). Walks on 6' board with alternate feet with one to three steps off (LDS). From run makes broad jump more than 23" (LDS). "Skips" on one foot (Gallop) (LDS) (CDP).	Boxes, hoops, tires to hop into and onto.	
36-57	Hops (Denver).	Obstacles or areas marked on floor	Beware of protruding objects, sharp edges.
37	Jumps from 18" height; both feet (M&W)	Obstacles to jump from	Soft surfaces to jump onto.
37.1	Jumps from 30 cm height; both feet (Bayley).		
37-48	Distance jumped 10-35 cm (Berry) (Bayley).		

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
38	Jumps 36-60 cm (Corbin). "Hops" on 2 feet 1-3 times (M&W) (Wellman).		
39	Walks down stairs using rail, one foot per step (MT).		
39-60	Heel to toe walk (Denver).	Balance beam, walking board	Clear area round apparatus.
40-45	Climbs stairs one foot per step without rail	Monkey bars; climbing towers	Place equipment over soft, padded surface
41-72	Jumps over rope 20 cm high (Berry). (Bayley).		
42	Walks up and down stairs, no rail both feet to same step (MT).		
43	Hop on one foot 1-3 times (Bayley) (Wellman).		
46-55	1-10 consecutive hops (Corbin) (Wellman).		
48	Hops in same place with feet together 7 times (OT).	Hopscotch game	
	Fundamental slide to preferred side (Sinclair).	Jungle gym	
	Climbs ladder foot over foot with opposition (Sinclair).	Rope ladder Cargo net	
	Jumps 60-85 cm (Corbin)	Rope with knots to climb	
	Running broad jump 23-33" (Corbin) (CDP)	Obstacles to jump over, into or onto Climbing tower	Sharp edges; protruding objects.
48-60	Runs 35 yards in less than 10 seconds (LDS).	Jump rope	
	Walks full length of 6 cm. board (LDS).	String	
	From running start, vertical jump of 2-1/2-3' (LDS).	Obstacles Tires	
	Skips alternating feet (LDS) (60, W&L).	Jump rope	
48	Jumps 2 inches high from couch (CDP).		
49	Hops on one foot less than 2 meters (Berry) (30, Bayley).		

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
50-60	Hops on one foot farther than 2 meters (LDS) (Bayley).		
54	Walks with one foot directly behind the other. Can slide in either direction. Gallops well (E&E).		
60	Skips with both feet alternately and smoothly (CDP). Well developed forward roll (Sinclair).		
48-60	Runs up and down stairs alternating feet (LDS). Runs 35 yards in less than 9 seconds (LDS).		
54	Walks up and down stairs, one foot per step, without rail support (MT). Walks with one foot directly behind the other (MT).	Stilts Balance beam	
60	Can walk a distance on tiptoe (CDP) 81% of children proficient at jumping (Gutteridge). Running broad jump 28-35" (Corbin). Vertical jump and reach 2-1/2" (Corbin). Hops on one foot for a distance of 5 meters (OT). Hope 50' in 10 seconds (Keogh).		Beware of pointed and sharp edges.
60-72	Walks full length of 4" board (LDS). Runs 35 yards in less than 9 seconds (LDS). From run makes broad jump less than 40" and vertical 23-1/2 (LDS). Hops on one foot 50' in 9 seconds (LDS). Learns to roller skate and/or ice skate if given an opportunity (E&E). Learns to use pogo stick or stilts. Learns to use bongo board if given an opportunity	Roller skates Ice skates Pogo stick Balance board, bongo board, stabilometer	Make sure Skates which clamp on securely

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
66	Run Figure-8 course with good balance (Sinclair).		
70	Runs 30-yard dash in 6.7 seconds (Kirchner).		
72	Runs 30 yard dash in less than 6.6 seconds (Kirchner). Standing broad jump 37.5 inches (Kirchner). Hope 50' in 10 seconds (Keogh).		
72-84	Hops on either foot as well does not alternate side symmetrically (Purdue).		
84	Runs 30 yard dash in 6.1 seconds (Kirchner). Standing broad jump 42.5" (Kirchner) (Keogh). Hops 50' in 5-7 seconds (Keogh).		
96	Standing broad jump 45.5" (Kirchner). Hops 50' in 5.7-6 seconds (Keogh).		
108	Hops 50' in 5.2-6 seconds (Keogh).		
108-120	Hops well on either foot and alternates sides symmetrically.		

Conditions to Develop Locomotor Skills

Activity:

1. Learner Outcome - To develop locomotor skills.

2. Conditions
   a. Learner Characteristics - 5-8 year olds
   b. Situational Variables - group activity on playground
   c. Strategy - Directive

   Procedure:

   Direct child through obstacle course.

   d. Content - The obstacle course will consist of (1) an 8 foot-long, 4 inch wide balance beam which the child must walk down in the

forward position, (2) two trees which the child must walk between without touching either, (3) six broad stones placed in a circle which the child must walk around, (4) a four foot by four inch balance beam which the child must walk forward on, and (5) hopping on two feet to the course beginning without difficulty, then she can switch to hopping on one foot.

Activity: "This is the Way we March Around"

1. Learner Outcome - To develop rhythmic movement in locomotor skills of marching, running, etc.

2. Conditions
   a. Learner Characteristics - 3 to 6-year-olds
   b. Situational Variables - classroom; group activity
   c. Strategy - Developmental

   Procedure:

While singing the song, the children do what each verse says. They may suggest other motor activities to sing about.

Song: This is the way we march around,
march around, march around,
This is the way we march around,
we march around the room.

Other activities may be substituted for "march":
run
hop
jump
skip
slide
crawl, etc.

3. Resource - McAree, Nimnicht, and Meier, New Nursery School, Booklet VI, p. 44.

Activity: Jack-in-the-Box

1. Learner Outcome - To develop coordination necessary for locomotor skills of squatting and jumping.

2. Conditions -
   a. Learner Characteristics - 2-6 year olds
   b. Situational Variables - small or large group activity; classroom or playground
   c. Strategy - Directive

Procedure:

The teacher motivates the children with a two or preferably three dimensional Jack-in-the-box. She then explains that it will be fun to pretend to be a Jack-in-the-box. She repeats the chant and demonstrates the activity quietly and slowly to build suspense. The children squat with their hands on their heads (holding the lid down on the box). On the word LID, they spring up and jump with legs apart.

d. Content - a picture or toy of a Jack-in-the-box; chant - Jack is hiding down in his box until somebody opens the LID!

Activity: Move as the Animals Move

1. Learner Outcome - To develop locomotor skills.

2. Conditions
   a. Learner Characteristics - kindergarteners
   b. Situational Variables - group activity in classroom
   c. Strategy - Directive

   Procedure:

   The teacher whispers in a child's ear suggesting the movements of an animal, i.e., "Crawl like a snake", "Jump like a rabbit". The child then tries to mimic the movement while the other children try to guess the animal. At first pictures of the animals should be visible to help the children guess. Later the teacher could suggest a child look at a set of pictures and choose the animal and movement he wishes; or he could listen to music and decide which animal would move fast or slow or whatever would best fit the tempo and mood of the music.

   d. Content - pictures of animals, and record

3. Resource - Cornell handbook of activities, "School Before Six", p. 258.

Activity: Let's Take a Trip

1. Learner Outcome - To develop locomotor skills such as walking, hopping, jumping, marching, sliding, galloping, crawling.

2. Conditions
   a. Learner Characteristics - 2-6 year olds
   b. Situational Variables - classroom activity for a group
   c. Strategy - Directive

   Procedure:

   The teacher introduces the concept of imagination and "pretend" by telling the children that they will pretend to take a trip. The children repeat the phases the teacher says - example: To begin the trip, the teacher says "Let's take a trip" (children repeat), "all right!" (repeat), "Let's Do" (repeat). Children imagine themselves in a forest - come to a large tree - must be climbed. Then skip, hop, etc. - come to river - must swim across. Then walk on - come to bridge - march across. Slide and gallop on, come to briar patch - must go through. Then walk backwards and tip toe. Come to cave - must crawl through. Meet bear - run back "in place" So through each experience in reverse order until you arrive home safely and lock the door.

   d. Content - none.

Activity:

1. Learner Outcome - To develop locomotor skills

2. Conditions
   a. Learner Characteristics - 5-8 year olds
   b. Situational Variables - group activity in playground

c. Strategy - Directive

Procedure: Direct child through obstacle course.

d. Content - the obstacle course will consist of (1) an 8 foot long, 4 inch wide balance beam which the child must walk down in the forward position, (2) two tress which the child must walk between without touching either, (3) six broad stones placed in a circle which the child must walk around, (4) a four foot by four inch balance beam which the child must walk forward on, and (5) hopping on two feet to the course beginning without difficulty, then she can switch to hopping on one foot.

The following activities are also appropriate for developing locomotor skills.

Squirrels and Trees

Directions: The group is divided and numbered in threes. Numbers 1 and 2 join hands to represent the tree. Number 3 is the squirrel and stands in the circle formed by the other two. There should be one or more odd squirrels without trees. The groups of threes are scattered over the play area. At a signal from a leader, the squirrels change trees and while they are changing, the odd squirrels attempt to get into trees. Only one squirrel is allowed in one tree at the same time. Someone is always left without a tree. As soon as all trees are full, the game is repeated.

Teaching Suggestions:

1. The signal may be a clap of the hands, a whistle, a chord from the piano, or just the word "change".
2. Watch the shy child and be sure that he changes.
3. Change the places of the players so that all have a chance to play the part of the squirrel.
4. Make it more fun by making it more daring; tell the children to choose a tree far from them to run into.
5. Three, four, or more players may form each tree if the group is large.

Brownies and Fairies

Draw two lines about 40 feet apart for goals. The players in two equal groups stand behind the goals. One group (fairies) turns backs, while the others (brownies) creep up as quietly as possible. The leader or teacher is watching and when they are near calls, "Look out for the brown !" The fairies then chase the brownies to their goal and tag as many as they can. All who are caught are fairies. Then brownies turn backs and fairies come up quietly, etc. The side having the greater number at the end of six chasings, or of available time, wins.

Quiet Activities

Duck, Duck, Goose

(Gym, playground, classroom) no equipment

Directions: All the players but one stoop or sit in a circle. The odd player walks around the outside of the circle, touching each player lightly on the head and repeating the word "Duck, duck, duck". This continues until the "It" player touches a head and says the word, "Goose", whereupon the player jumps up from the circle and as rapidly as possible chases the "It" person. If the chaser succeeds in catching the "It" person before he reaches the vacant space in the circle, he may then be the one to be the next "It". If he fails to tag "It", he returns to his space in the circle and "It" continues the game.

Basic Locomotive Skills and Shows (Animal-Imitations)

Measuring Worm

Place the hands on the floor, shoulder width apart, extend the legls to the rear, feet together, thus supporting the body on the arms and toes; arms straight and body in one straight line from head to heels. With the hands stationary and knees straight, bring the feet up by little steps as close to hands as possible. Next, keeping the feet stationary, move hands forward with little steps until starting position is again reached. At no time should body sag. Repeat several times, progressing forward.

Horse Galloping

Do a "follow-step" keeping left foot in advance, left knee raised high, back straight. This is done by standing on the right foot with left knee raised high in front. Step forward on left foot and bring up the right to the heel of the left. Then raise left knee and repeat. After leading with the left foot for some time, lead with the right.

Chicken Walk

The pupil stands with his feet together, squats deeply and spreads his knees apart, places his hands outside of his thighs and clasps his hands tightly in front of legs, below the knees. After having completed this, he walks forward on his toes with very short steps.

Walrus

The pupil falls forward, resting his palms on mat, elbows stiff, body extended backward in a straight line from shoulders to heels. After assuming this position, he travels forward on his hands, dragging his legs behind on toes, keeping knees stiff.

Ducks

Deep knee bend, hands on knees, walk forward in this position. Place hands behind back, palms together, fingers pointing backward to make a duck tail. Walk in this position.

Frogs

Deep knee bend, place hands on floor. Move hands forward and let feet follow with a jump. Kicking legs out behind to imitate a frog.

Purposive Movements

Purposive movement includes all movements which are primarily designed to have an effect on some external object. For example, throwing and catching a ball represent two opposite types of purposive movements: the production of force and the reception of force. Bouncing a ball requires the sequential combination of these two types.

The production of force sufficient to have some effect on an external object or person is a primary accomplishment for children. Not only must the force be sufficient to overcome the resistance, but it must also be controlled in terms of the magnitude of the force and the length of time (duration) of its application. As a child learns to kick or throw a ball to a parent or friend, the problems of overthrowing and underthrowing are obvious.

The absorption or reception of force includes the complex interaction required for maintaining balance (equilibrium) while receiving the impetus or momentum of a moving object. This problem is further complicated by the necessity to absorb the force without allowing the object to rebound from the body or to cause injury. Catching a rubber ball without it rebounding out of the hands is difficult, but more significant are the problems implicit in bouncing on a large board or trampoline, when the child is attempting to propel and control his own body.

Many perceptual elements impinge on the child, who must be able to identify the force of the oncoming object in terms of both its weight and its speed. In addition, many forms of purposive movements are dependent upon the attainment of varying degrees of eye-hand coordination. The eyes must focus on the object to be received or acted upon, and the appropriate body parts must respond to the judgments made through the sensory systems. Catching a ball, striking a ball or tether ball, and kicking a ball are purposive skills which require the establishment of eye-hand or eye-foot coordination. These coordinative problems become magnified as the child begins to move through space while executing purposive movements (i.e., running and kicking or catching a ball) or when an implement is added (i.e., baseball bat or croquet mallet).

Developmental sequences for purposive skills have been fairly well established. (Wild, 1938; McGraw, 1945; Deach, 1950; Wickstrom, 1970). Perhaps the most fundamental skill in this area is the overhand striking-throwing pattern which first emerges in the young child. This pattern appears to be the forerunner of the mature overhand throw, which develops much later, and for the transition to the sidearm striking patterns.

Wild, (1938) identified the developmental sequence for the overarm throw, which illustrates the gradual addition of the more mature concepts of rotation and sequential joint action.

The ball is thrown primarily with forearm extension but the feet remain stationary and the body does not rotate.

Rotatory movement is added to the pattern during the preparatory movement, the hand is cocked behind the head and the trunk rotates.

A forward step with the leg on the same side of the body as the throwing arm produces additional forward force for the throw.

In the mature pattern, the arms and trunk rotate backward in preparation for the throw, followed by a step forward. As the hips, trunk and shoulders rotate, the elbow swings forward and the forearm and wrist extend in releasing the ball.

The earliest form of striking seems to derive from the overarm motion. This includes the developmental progression of a step forward on the same foot (non-opposition), followed later by the mature opposition of arm and leg. Correspondingly, the rotatory movements of the hips increase and opposition occurs. If the child's striking skills develop without assistance, the pattern will likely progress from a vertical plane downward through a series of increasingly flatter planes to an effective pattern predominantly in a horizontal plane (Wickstrom, 1970).

Several developmental changes can be identified in the striking patterns of children (Wickstrom, 1970).

More freedom in the swing with increased range of motion.
More use of the forward step and forward weight shift to initiate the pattern. This also delays the arm action for more effective force production.
More definite hip and trunk rotation which precedes the action of the arms.
More uncocking of the wrist for a "snap" at the moment of release.

The development of the kicking pattern seems to be primarily linked to the attainment of equilibrium while standing on one foot and swinging the opposite foot. Deach (1950) identified a series of developmental stages for kicking skills.

The child essentially moves against the ball, with minimal forward movement of the lower leg or arms and trunk for counterbalance. The kicking action itself is essentially a forward and upward action, with the kicking leg remaining straight.
A preparatory backward lift of the kicking foot is added, caused by flexion of the leg.
The total arc of the leg is increased, accompanied by a compensatory movement of the opposite arm.
In the mature stage, the leg travels through a greater range of motion. The arms and trunk must then compensate for both the preparatory and contributory actions. The leg is cocked increasingly, both at the knee and the hip.

The developmental sequence for catching reflects the complex interaction of eye-hand coordination and the development of fine motor control. Wickstrom (1970) described a series of five stages in the development of catching skills, with the first attempts at catching actually dealing with the problems of maintaining control of a rolled ball.

1. When sitting with legs spread, the child attempts to grasp it or trap it against one leg when the ball is slowly rolled.

2. While standing, the arms are extended straight ahead; the child allows the ball to bounce off the body and chases it to control the rolling or bouncing ball.

3. The child provides a nest for the ball with the extended arms being bent at the elbow; the ball may then be tossed into the nest and the child may trap the ball against the chest.

4. The child gradually reduces the amount of utilization of the chest and the ball is cradled in the arms.

5. In the mature catch the ball is caught using the hands only, with flexion of the arms serving to absorb the force.

Ontogeny and Appropriate Equipment for Purposive Movement

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
6-12	Rolls, projects or flings balls underhand, side-arm, or overhand (LDS).	A variety of sizes and shapes of balls with a variety of colors and textures.	Begin with large sized balls and progress to smaller sizes
9.8	Attempts to "play ball" with adult (Denver).		Begin with soft objects, i.e. fleece balls or soft rubber which have some "give" in them for easy grasping
9-18	Throws ball (Bayley).		
15-24	Kicks ball forward (Bayley) (Denver) (MIT).	Large, soft rubber balls	
18-24	Kicks ball without over-balancing (LDS) (Gessell) (W&L).		Allow kicking in a clear, open area.
24	Throws large ball (accuracy not required) (MIT). Tosses tennis ball forward (CDP).	Punching type toy or punching bag	
27	Bounces 9 1/2" ball 1-3 ft, with one hand (E&E).		
24-36	Catches a large tossed ball with arms extended (LDS) (Wellman).	Large, soft balls	Face, head, and finger injury if hard object utilized
30	Should catch 2 of 3 well thrown balls (Sinclair)		
21-36	Pedals tricycle (Denver) (MT).	Tricycle	Be sure tricycle is correct size- seat, pedal, handlebars; Check braking and steering
24-36	Overhand throw with extension of forearm only (Wild).	Simple rolling and throwing games; Targets to throw at Bowling ball & pins; ten pins	

Ontogeny and Appropriate Equipment for Purposive Movement

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
30	Strikes ball with bat off a batting tee (Sinclair).	Bat Batting tee Tether ball (Ball suspended by rope for striking)	Rubber or plastic bats to avoid severe injury
33-36	Throws eight to ten inch ball 6-7 ft. (CDP) (Wellman).		
33	Throws ball without losing balance (LDS).	Bowling ball and pins: ten pins	
36	Rides tricycle using pedals (OT)	Tricycle	
36-48	Can bounce and catch ball with both hands (LDS).	A variety of sizes and shapes of balls	
40	Bounces a ball 4-5 ft. (E&E).		
42	Bounces a small ball with one hand (Sinclair) Overhand throws with some body rotation & greater arm range (Wild).		
46	Bounces a large ball with 2 hands at least 4-5 ft. (E&E).		
48	Throws tennis ball with overhand throw (CDP) (W&L). Bats a large ball (Sinclair)	Paddle with ball attached; croquet set	Be sure ball is securely attached & made of soft rubber
41-66	Catches bounced ball		
48-60	Bounces ball at least 3 times (dribbles) with each hand (LDS)	Basketball Soccer ball Rubber ball	
48-72	Learns to ride bicycle	Bicycle	Be sure to have correct size; check braking & steering systems

Ontogeny and Appropriate Equipment for Purposive Movement

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
51-68	Catches large ball with elbows flexed (MT) (Wellman).		
54	Bounces ball at least 4 times (Sinclair).		
57	Catches bounced ball (Denver).		
60	Kicks eight to ten inch ball 8 ft. in air (CDR). Kicks soccer ball 8-11 1/2 ft. (Gesell).		
60-72	Overhand throw non-opposition with forward step (Wild). 74% of children are skilled at ball throwing (CDR).	Punching bag and gloves	
60-72	Dribbles ball 10 times with each hand (LDS).		
60-72	Catches ball with consistency.	Baseball glove	
72	Kicks soccer ball 10-18 ft. (Gessell)		
72	Advances throwing (W&L) To throw ball at a target (1.5 m away) (OT). Throws small ball 15 ft. (Wellman)		
72-84	Throws 12" ball 20-34 ft. (Keogh)	Badminton game	
78	Overhand throw opposition and rotations added (Wild).	Tennis racket	
84	Kicks soccer ball 15-25 ft. (Jenkins).		

Ontogeny and Appropriate Equipment for Purposive Movement

Age in Months	Stage	Appropriate Equipment	Potentially Hazardous Conditions
84-96	Throws 12" ball 26-45 ft. (Keogh)		
96	Kicks a box a distance of 5 meters hopping on one foot (OT).		Avoid pointed darts Use velcro fabric or suction cups or non-pointed objects
96-108	Throws ball 34-60 ft. (Keogh) and at target (OT).	Velcro dart game Yard darts Target throw games	

Conditions to Develop Purposive Movements

Activity: Hot Potato

1. Learner Outcome - To develop ability to pass and receive an object.

2. Conditions
   a. Learner Characteristics - 6-7 year olds
   b. Situational Variables - Group activity in classroom
   c. Strategy - Directive

Procedure:

Have children form circle. Play music. The children pass the potato to the next child in the circle. The child must pass and not throw the potato. The child caught with the potato when music stops must sit down.

COGNITIVE COMPETENCIES

Cognitive competencies the trainee will demonstrate include:

1. Understanding of the physical and physiological development in visual perception and motor skills for children birth through seven years.

2. Knowledgeability of situations and materials which develop motor and visual perceptual skills.

3. Historical perspective on the theories of visual perception and motor relevant to current learning theory and practices.

4. Working knowledge of ontogenetic gradients of visual and motor behavior.

5. Knowledgeability about visual perceptual and motor dysfunctions in children birth through age seven.

The course competencies will be accomplished through the following activities:

1. Reading assignments
2. Materials presented in lectures
3. Preparation of a written review of the literature on some aspect of motor development and presentation of the findings to the class. Presentations must be informative, interesting, and demonstrative of your knowledge. A list of possible topics will be given in class.
4. Presentation of 3 lesson plans in each major area of development (perceptual, physical and perceptual motor). Implementation of 1 of the 3 plans in each area with young children. The plan should be submitted to the instructor before implementation. A short evaluation of the experience will be written after the implementation.
5. The trainee will prepare two case studies relating to the motor development of the young child. One case study is to be of infant age, the other with a child ranging from 4 to 6 years of age. The following instruments are to be administered to gather information for the case studies:

Infant Case Study:	Denver Developmental Bayley
Preschool Case Study:	Purdue Frostig and/or Beery Art, and movement evaluations

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